

# ***GEOMORPHIC DESCRIPTION SYSTEM***

**Version 5.0**

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**NATURAL RESOURCES CONSERVATION SERVICE**

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**Cover Photo:** Wind River Range, WY (N42.69° Lat., W109.16° Long.) approximately 25 miles southwest of Lander. Glaciated mountains with arêtes, horns, cirques, and tarns. View is towards the southwest. The snow patch, at lower, middle image, is on Wind River Peak's north flank. This peak and the adjacent north-south, sharp-crested ridge mark the continental divide. East Temple and Temple peaks are west of the divide. The larger tarns include Tayo, Frozen, Temple, and Deep Lakes. The underfit, southerly flowing stream in a U-shaped valley is Little Sandy Creek. Photo by Doug Wysocki, August 2007.

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## Acknowledgments

This document builds upon and in part is a testament to earlier geomorphologic publications focused toward Soil Survey. Two publications deserve specific mention -- John Hawley and Roger Parsons's *Glossary of Selected Geomorphic and Geologic Terms* (1980) provided landform definitions for the western USA; and Fred Peterson's landmark *Landforms of the Basin and Range Provinces defined for Soil Survey* (1981) devised a regional landform description guide combined with outstanding graphics. Soil scientists used the geomorphic and geologic terminology summarized in those documents during an important soil inventory era in the USA. These early contributions formed a foundation and gave inspiration for this larger endeavor and the companion document *Glossary of Landform and Geologic Terms (National Soil Survey Handbook – Part 629, NRCS, current date)*.

We dedicate special thanks and recognition to Dr. Erling Gamble (USDA - Soil Conservation Service, retired) who participated in the formative stage of the *GDS* and *Glossary*. His training with Dr. James Thorpe (Earlham College) and collaborative work with Dr. Raymond Daniels (USDA- SCS, retired), as well as his own growth in this profession are a thoughtful and constructive part of this work. The Soil Science Division of the USDA – Natural Resource Conservation Service supported this project.

The initial GDS release (1994) was an internal NRCS document. A condensed external GDS publication (Version 2.06) followed (Schoeneberger and Wysocki, 1998). Additional upgrades have been issued since then. This version (5.0) updates and replaces all previous GDS versions.

## FOREWORD

**Purpose:** This document provides a descriptive method and a technical guide for applying and understanding geomorphic and geologic concepts and terms for soil inventory used by the National Cooperative Soil Survey (NCSS) Program in the USA.

**Content:** Definitions, criteria, concepts, and operational guidelines presented here focus on soil inventory needs and applications. Our main goal is clear, consistent definitions and concepts with succinct presentation. Space precludes expansive treatment of all definitions or concepts included herein. Users who seek such should consult original cited sources and additional references.

**Sources:** This document is a primary source for geomorphic terminology and application for USDA-NRCS and National Cooperative Soil Survey programs. This Geomorphic Description System is contained, in part or in total, in key NRCS documents: National Soil Survey Handbook (*NSSH*), Part 629 (Soil Survey Staff, 2017); the Field Guide for Describing and Sampling Soils, version 3.0 (Schoeneberger, et al., 2012; limited content superceded by later NASIS updates); National Soil Information System (*NASIS*), ver. 6.2 (NRCS, 2012). Information drawn from other original sources is noted and given appropriate citation in this document. We hope this facilitates access to original sources and encourages greater topical exploration and access to supplementary detail.

**Goal:** Observe and document what exists in the field. Choice lists and terms that follow constitute a minimal set of descriptors. Accurate, complete geomorphic field assessment may require additional adjectives, descriptors, or sketches to capture and convey pertinent information where established terms are lacking. Record the additional information as needed (e.g. free-hand notes).

**Changes:** Soil Science and Soil Geomorphology are evolving scientific fields. Changes in this system should and will occur. Please send comments or suggestions to the authors at the National Soil Survey Center, USDA - NRCS, 100 Centennial Mall North - Rm. 152, Lincoln, NE 68508-3866

**Status:** This version contains new terms (highlighted in **bold**) that have been recently added. These changes may post-date and therefore may not be shown in other related documents. Updates will be made to all related documents at the earliest opportunity.

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## BACKGROUND

Landforms are visually recognizable earth surface features that provide humans a sense of location. In fact, humans have informally described landforms throughout history mainly as landmarks, obstacles to travel, or for their military value. Soil occurrence across the earth's surface corresponds remarkably well with landform type and distribution. Soil scientists during the soil survey process develop landscape models that quantify soil / landform relationships. Soil scientists can understand and convey much about soil distribution by employing landform description. Effective communication of such knowledge, whether among scientists, or between scientists and the general public, requires accurate and consistent landform description.

A long-standing need exists to clarify and communicate geomorphic concepts and terms in Soil Science, as well as, the National Cooperative Soil Survey. A broadly applicable set of geomorphic descriptors needs to be comprehensive, consistently defined, and follow an organized array. This *Geomorphic Description System (GDS)* addresses those needs by presenting, defining, and organizing terminology. Various considerations include, but are not limited to, time constraints, the need to blend formal and informal terms and concepts, and competing terms and philosophies serve to complicate the GDS design. Consequently, this system is a compromise between straightforward practicality and strict scientific rigor.

### Goals in building the GDS:

- 1) Foster national use of standard terms:
  - Enhance the utility and scientific credibility of geomorphic information contained in National Cooperative Soil Survey databases and products.
  - Improve technical communication both within and outside NRCS.
  - Encourage use of established, scientifically credible terms.
- 2) Maximize use of existing geomorphic information in NCSS databases and programs.

### Specific Objectives:

- 1) Comprehensively organize geomorphic and related terminology for use in the National Cooperative Soil Survey (NCSS) and Soil Science.
- 2) Update, revise, and improve geomorphic terminology in the NCSS:
  - Develop new concepts and terms where needed.
  - Clarify terms to minimize erroneous use.
  - Remove obsolete terms and concepts.
  - Minimize redundant, competing, and conflicting terms [e.g. watercourse terms: arroyo, coulee, drainageway, draw, gulch, gully, ravine, and wash].
- 3) Completeness (incorporate user-requested modifications and needs):
  - Fill gaps: add or create terms in response to requests; construct "suites of terms" that provide all pertinent options.
  - Focus on previously under-represented regions and minimize regional biases.

# INTRODUCTION

This system is a comprehensive presentation of geomorphic terms used in the National Cooperative Soil Survey Program (NCSS) and in the Soil Science profession at large. It enable's one to effectively describe the geomorphic setting and context of a given point or area on the Earth's surface: to convey it's form and content, and, where possible, to indicate what processes or environments have dominated it's evolution and contributed to it's present state, composition, and distribution.

Categories (e.g., *Landscape*), are called “data elements” in the National Soils Information System (NASIS) and defined in Appendix 1. Each category (e.g., *Landscape*) contains many choices (e.g., *mountains, plains*) that are tallied in lists. All geomorphic “choice-list” terms are defined in the Glossary of Geologic and Landform Terms - Part 629, National Soil Survey Handbook, (Soil Survey Staff, 2012), which should be considered a companion document (and reproduced here as Appendix 2).

Many terms are drawn from geology, whereas others are modified for, or are unique to, Soil Science. The terminology and definitions are generally in agreement with, but in some cases more comprehensive than those in the Glossary of Soil Science Terms (Soil Science Society America, 2017) and the Glossary of Geology (American Geological Institute, 2005).

## GDS Organization

The ***Geomorphic Description System (GDS)*** consists of three main sections:

- I) **Physiographic Location** : Where - Specifies an existing and named geographic area with a defined location. <sup>1</sup>
  
- II) **Geomorphic Description** :
  - What - Identifies a discrete land surface feature (separate entity) or assemblage of features.
  
  - How - Categorizes features by dominant origin process or geomorphic setting.
  
- III) **Surface Morphometry** :
  - Shape - Describes land surface shapes or geometry.
  
  - Pieces - Identifies a discrete portion of a geomorphically defined land area or slope segment.

[ <sup>1</sup> Note: Physiographic Location choice-lists may contain area names that are geomorphically or geologically defined, but can also include culturally or geo-politically defined areas. Thus the terms used in the Physiographic Location section (= geography) may not be consistent with Glossary definitions. ]

# ***GEOMORPHIC DESCRIPTION SYSTEM***

( VERSION 5.0, 08/14/2017 )

## **ABBREVIATED OUTLINE**

### ***PART I : PHYSIOGRAPHIC LOCATION***

- A) PHYSIOGRAPHIC DIVISION
- B) PHYSIOGRAPHIC PROVINCE
- C) PHYSIOGRAPHIC SECTION
- D) STATE PHYSIOGRAPHIC AREA (OPTIONAL)
- E) LOCAL PHYSIOGRAPHIC / GEOGRAPHIC NAME (OPTIONAL)

### ***PART II : GEOMORPHIC DESCRIPTION***

- A) LANDSCAPES
- B) LANDFORMS
- C) MICROFEATURES
- D) ANTHROSCAPES
- E) ANTHROPOGENIC LANDFORMS
- F) ANTHROPOGENIC MICROFEATURES

### ***PART III : SURFACE MORPHOMETRY***

- A) ELEVATION
- B) SLOPE ASPECT
- C) SLOPE GRADIENT
- D) SLOPE COMPLEXITY
- E) RELATIVE SLOPE SEGMENT POSITION
- F) SLOPE SHAPE
- G) HILLSLOPE - PROFILE POSITION
- H) GEOMORPHIC COMPONENT :
  - 1) HILLS
  - 2) TERRACES, STEPPED LANDFORMS
  - 3) MOUNTAINS
  - 4) FLAT PLAINS
- I) MICRORELIEF
- J) DRAINAGE PATTERN

# **GEOMORPHIC DESCRIPTION SYSTEM**

(VERSION 5.0, 08/14/2017 )

## **DETAILED OUTLINE**

### ***PART I : PHYSIOGRAPHIC LOCATION***

- A) PHYSIOGRAPHIC DIVISION**  
( Formerly called Region in earlier versions;  
Choices are expanded from Fenneman, 1931, 1938 )
  
- B) PHYSIOGRAPHIC PROVINCE**  
( Choices are expanded from Fenneman, 1931, 1938 )
  
- C) PHYSIOGRAPHIC SECTION**  
( Choices are expanded from Fenneman, 1931, 1938 )

-----  
[ These final two levels are optional and intended to allow use of more localized area names. ]

- D) STATE PHYSIOGRAPHIC AREA (OPTIONAL)**
  - To be developed in conjunction with, or obtained from, the local State Geologic Survey or its equivalent.
  
- E) LOCAL PHYSIOGRAPHIC / GEOGRAPHIC NAME (OPTIONAL)**
  - To be developed in conjunction with, or obtained from, the local State Geologic Survey.
  - May include area names found on USGS 7.5 or 15 minute topographic maps.

Example for Physiographic Location:

- A. Interior Plains
  - B. Central Lowland
    - C. Wisconsin Driftless Section
      - D. Wisconsin Dells
        - E. Blackhawk Island

## **PART II : GEOMORPHIC DESCRIPTION**

[ A term should only be used once in a microfeature-landform-landscape descriptive string. For example, if a term is used as a landscape term (e.g. *river valley*) it should not be repeated as a landform term in the same descriptive string. A different term that conveys additional information should be used (at either level); e.g. *flood plain* (Landform) *in a river valley* (Landscape), rather than a *river valley* (Landform) *in a river valley* (Landscape). ]

### **A) LANDSCAPES**

examples: badlands  
foothills

### **B) LANDFORMS**

#### **1. Single Landform**

- occurrence on a single type of landform

examples: stream terrace, hill (singular: a pedon or point data)  
examples: stream terraces, hills (plural: pedons or map unit).

#### **2. Multiple Landforms:**

##### **a) Landform on a Landform** (nested landforms):

- Commonly used for locating a pedon or a small study site.  
- Listed in ascending order of scale.

examples: a blowout in a sand dune on a stream terrace.  
a mudflow on a cinder cone, in a caldera.

##### **b) Occurrence across multiple landforms**

- Commonly used for locating a map unit, Official Soil Series Descriptions, deposits, or large study sites.

example: This map unit occurs on levees, crevasse splays, and sand bars.

### **C) MICROFEATURES**

example: tree-tip mound

### **D) ANTHROSCAPES**

example: suburban anthroscap

### **E) ANTHROPOGENIC LANDFORMS**

example: borrow pit

### **E) ANTHROPOGENIC MICROFEATURES**

example: furrow

### **PART III : SURFACE MORPHOMETRY**

**A) ELEVATION:**

- The height of a point on the earth's surface, relative to mean sea level (msl); specify units.

examples: 106 m  
348 ft.

**B) SLOPE ASPECT:**

- The compass bearing (in degrees, accounting for declination) that a slope faces, looking downslope.
- Generalized, "quadrant" descriptions (e.g., SSW = south by southwest) are too generic to be useful.

examples: 218°  
SW (*too general; obsolete*)

**C) SLOPE 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; e.g., 18%; commonly called "slope".

example: 17%

**D) SLOPE COMPLEXITY:**

- Used to simplistically describe the relative linearity (simple) or irregularity (complex) of the ground surface leading downslope and through the point or map unit of interest.

examples: simple  
complex

**E) RELATIVE SLOPE SEGMENT POSITION:**

- Used to subdivide long slopes, where useful.

example: lower third

- F) SLOPE SHAPE:** *(paired terms)*  
 DOWN SLOPE & ACROSS SLOPE  
*(Vertical)*                      *(Horizontal)*
- examples: Concave - Convex  
 Linear - Concave
- G) HILLSLOPE - PROFILE POSITION**
- 2 dimensional
  - Used to describe location of a point or pedon along a longitudinal slope profile (down slope).
  - Appropriate for use with point data, generally not recommended for map units.
- examples: shoulder  
 backslope
- H) GEOMORPHIC COMPONENT:**
- 3 dimensional
  - Used to describe location of areas (e.g. map units, inclusions).
- 1) HILLS :**  
 examples: head slope  
 side slope
  - 2) TERRACES, STEPPED LANDFORMS :**  
 examples: tread  
 riser
  - 3) MOUNTAINS :**  
 example: mountainflank
  - 4) FLAT PLAINS :**  
 examples: talf  
 rise
- I) MICRORELIEF :** Microrelief refers to minor, relative elevational differences between adjacent areas or microfeatures).
- example: microhigh
- J) DRAINAGE PATTERN :** The configuration or arrangement, in plan view, of the stream courses in an area. It is related to the local geologic materials, geomorphologic features and history of the area; examples include dendritic, trellis, artificial, etc.; also called “drainage network”.
- example: dendritic

# GEOMORPHIC DESCRIPTION SYSTEM

( VERSION 5.0, 08/14/2017 )

## PART I: PHYSIOGRAPHIC LOCATION

- A) **PHYSIOGRAPHIC DIVISION**  
( Choices are expanded from Fenneman, 1931, 1938, 1946)
- B) **PHYSIOGRAPHIC PROVINCE**  
( Choices are expanded from Fenneman, 1931, 1938, 1946)
- C) **PHYSIOGRAPHIC SECTION**  
( Choices are expanded from Fenneman, 1931, 1938, 1946)
- 
- D) **STATE PHYSIOGRAPHIC AREA** (OPTIONAL)
- E) **LOCAL PHYSIOGRAPHIC / GEOGRAPHIC NAME** (OPTIONAL)
- 

[ Note: The following map-unit descriptions (Fenneman, 1946) contain some concepts considered to be outdated (e.g., the Davisian landscape stages of youth, maturity, and old age). Nonetheless, the map units are largely sound and convey useful information. An italicized NASIS code, if available, follows each term (e.g., Coastal Plain *CP*). ]

### A) Physiographic Divisions

**Laurentian Upland** *LU*

**Atlantic Plain** *AP*

### B) Physiographic Provinces

#### C) Physiographic Sections

1. Superior Upland *SU*

[ Submaturely dissected, recently glaciated peneplain on crystalline rocks of complex structure. ]

2. Continental Shelf *CS*

[ Sloping submarine plain of sedimentation; *not delimited on NRCS map used in this document.* ]

3. Coastal Plain *CP*

a. Embayed section *EMS*

[ Submaturely dissected and partly submerged, terraced coastal plain. ]

b. Sea Island section *SIS*

[ Young to mature terraced coastal plain with submerged border. ]

c. Floridian section *FLS*

[ Young marine plain, with sand hills, swamps, sinks, and lakes. ]

d. East Gulf Coastal plain *EGC*

[ Young to mature belted coastal plain. ]

e. Mississippi alluvial valley *MAV*

[ Flood plain and delta. ]

f. West Gulf Coastal plain *WGC*

[ Young grading inland to mature coastal plain. ]

## Physiographic Divisions

### **Appalachian Highlands** AH

## Physiographic Provinces & Sections

4. Piedmont Province PP
  - a. Piedmont upland PIU  
[ Submaturely dissected peneplain on disordered resistant rocks; moderate relief. ]
  - b. Piedmont lowlands PIL  
[ Less uplifted peneplain on weak strata; residual ridges on strong rocks. ]
  
5. Blue Ridge Province BR
  - a. Northern section NOS  
[ Maturely dissected mountains of crystalline rocks; abundant altitudes. ]
  - b. Southern section SOS  
[ Subdued mountains of disordered crystalline rocks]
  
6. Valley and Ridge Province VR
  - a. Tennessee section TNS  
[ Second-cycle mountains of folded strong and weak strata; valley belts predominate over even-crested ridges. ]
  - b. Middle section MIS  
[ The same as previous section except that even-crested ridges predominate over the valleys except on the east side. ]
  - c. Hudson Valley HUV  
[ Glaciated peneplain on weak folded strata. ]
  
7. St. Lawrence Valley SL
  - a. Champlain section CHS  
[ Rolling lowland, glaciated; in part covered by young marine plain. ]
  - b. St Lawrence Valley - northern section NRS  
[ Young marine plain with local rock hills. ]
  
8. Appalachian Plateau AP
  - a. Mohawk section MOS  
[ Maturely dissected glaciated plateau; varied relief and diverse altitudes. ]
  - b. Catskill section CAS  
[ Maturely dissected plateau of mountainous relief and coarse texture (glaciated). ]
  - c. Southern New York section SNY  
[ Mature glaciated plateau of moderate relief. ]
  - d. Allegheny Mountain section AMS  
[ Mature plateau of strong relief; some mountains due to erosion of open folds. ]

## Physiographic Divisions

### **Appalachian Highlands** AH ( continued )

## Physiographic Provinces & Sections

- e. Kanawha section KAS  
[ Mature plateau of fine texture; moderate to strong relief. ]
- f. Cumberland Plateau section CPS  
[ Submaturely dissected plateau of moderate to strong relief. ]
- g. Cumberland Mountain section CMS  
[ Higher mature plateau and mountain ridges on eroded open folds. ]

### 9. New England Province NE

- a. Seaboard lowland section SLS  
[ Peneplains below 500 ft. elevation, postmaturely eroded and glaciated; few monadnocks. ]
- b. New England upland section NEU  
[ Dissected and glaciated peneplains on complex structural features; monadnocks. ]
- c. White Mountain section WMS  
[ Subdued glaciated mountain masses of crystalline rocks. ]
- d. Green Mountain section GMS  
[ Linear ranges of subdued and glaciated mountains and residual plateaus. ]
- e. Taconic section TAS  
[ Maturely dissected and glaciated mountains and peneplain on resistant folded strata. ]

### 10. Adirondack Province AD

[Subdued mountains and dissected peneplain, glaciated.]

### **Interior Plains** IN

### 11. Interior Low Plateaus IL

- a. Highland rim section HRS  
[ Young to mature plateau of moderate relief. ]
- b. Lexington lowland LEL  
[ Mature to old plain on weak rocks, trenched by main rivers. ]
- c. Nashville basin NAB  
[ Mature to old plain on weak rocks; slightly uplifted and moderately dissected. ]
- d. Possible western section WES  
[ Low, maturely dissected plateau with silt-filled valleys. ]  
(not delimited on map)

### 12. Central Lowland Province CL

- a. Eastern lake section ELS  
[ Maturely dissected and glaciated cuestas and lowlands; moraines, lakes, and lacustrine plains.]

## Physiographic Divisions

### **Interior Plains** *IN* ( continued )

## Physiographic Provinces & Sections

- b. Western lake section *WLS*  
[ Young glaciated plain; moraines, lakes, and lacustrine plains. ]
- c. Wisconsin driftless section *WDS*  
[ Maturely dissected plateau and lowland invaded by glacial outwash. (Margin of older, eroded drift is included). ]
- d. Till plains *TIP*  
[ Young till plains; moraine topography is rare, no lakes. ]
- e. Dissected till plains *DTP*  
[ Submaturely to maturely dissected till plains. ]
- f. Osage plain *OSP*  
[ Old scarped plains beveling faintly inclined strata; main streams are entrenched. ]

### 13. Great Plains Province *GP*

- a. Missouri plateau, glaciated *MPG*  
[ Glaciated old plateaus; isolated mountains. ]
- b. Missouri plateau, unglaciated *MPU*  
[ Old plateau; terrace lands; local badlands; isolated mountains. ]
- c. Black Hills *BLH*  
[ Maturely dissected domed mountains. ]
- d. High Plains *HIP*  
[ Broad inter-valley remnants of smooth fluvial plains.]
- e. Plains Border *PLB*  
[ Submaturely to maturely dissected plateau. ]
- f. Colorado Piedmont *COP*  
[ Late mature to old elevated plain. ]
- g. Raton section *RAS*  
[ Trenched peneplain surmounted by dissected, lava-capped plateaus and buttes. ]
- h. Pecos valley *PEV*  
[ Late mature to old plain. ]
- i. Edwards Plateau *EDP*  
[ Young plateau with margin of moderate to strong relief. ]
- k. Central Texas section *CTS*  
[ Plateau in maturity and later stages of erosion. ]

[ This Division also includes portions of Alaska (see Alaskan Physiographic Areas) ]

### **Interior Highlands** *IH*

### 14. Ozark Plateau *OP*

- a. Springfield-Salem plateaus *SSP*  
[ Submature to mature plateaus. ]
- b. Boston "Mountains" *BOM*  
[ Submature to mature plateau of strong relief. ]

## **Physiographic Divisions**

**Interior Highlands** *IH*  
( *continued* )

**Rocky Mountain System**  
*RM*

[ *This Division also includes portions of Alaska (see Alaskan Physiographic Areas)* ]

**Intermontane Plateaus** *IP*

## **Physiographic Provinces & Sections**

15. Ouachita Province *OU*  
a. Arkansas Valley *ARV*  
[ Gently folded strong and weak strata; peneplain with residual ridges. ]  
b. Ouachita Mountains *OUM*

16. Southern Rocky Mountains *SR*  
[ Complex mountains of various types; intermontane basins. ]

17. Wyoming Basin *WB*  
[ Elevated plains in various stages of erosion; isolated low mountains. ]

18. Middle Rocky Mountains *MR*  
[ Complex mountains, mainly anticline ranges; intermontane basins. ]

19. Northern Rocky Mountains *NR*  
[ Deeply dissected mountain uplands, not anticline ranges; intermontane basins. ]

20. Columbia Plateau *CR*  
a. Walla Walla Plateau *WWP*  
[ Rolling plateau with young incised valleys. ]  
b. Blue Mountain section *BMS*  
[ Complex mountains and dissected volcanic plateaus. ]  
c. Payette section *PAS*  
[ Young plateaus of prevailing weak rocks; broad alluvial terraces. Applies only to northern part. ]  
d. Snake River Plain *SRP*  
[ Young lava plateau. ]  
e. Harney section *HAS*  
[ Young lava plateaus, features of recent volcanism; ineffective drainage. ]

21. Colorado Plateau *CO*  
a. High Plateaus of Utah *HPU*  
[ High block plateaus, in part lava-capped; terraced plateaus on the south side. ]  
b. Uinta Basin *UIP*  
[ Dissected plateau; strong relief. ]  
c. Canyon Lands *CAL*  
[ Young to mature canyoned plateaus; high relief.]

## Physiographic Divisions

### **Intermontane Plateaus** *IP* ( continued )

## Physiographic Provinces & Sections

- d. Navajo section *NAS*  
[ Young plateaus; smaller relief than 21c, into which it grades. ]
- e. Grand Canyon section *GCS*  
[ High block plateaus, trenched by Grand Canyon.]
- f. Datil section *DAS*  
[Lava flows entire or in remnants; volcanic necks.]

### 22. Basin and Range Province *BP*

- a. Great Basin *GRB*  
[ Isolated Ranges (largely dissected block mountains) separated by aggraded desert plains.]
- b. Sonoran Desert *SOD*  
[ Widely separated short ranges in desert plains. ]
- c. Salton Trough *SAT*  
[ Desert alluvial slopes and delta plain, Gulf of CA]
- d. Mexican Highland *MEH*  
[ Isolated ranges (largely dissected block mountains) separated by aggraded desert plains.]
- e. Sacramento section *SAS*  
[ Mature block mountains of gently tilted strata; block plateaus; bolsons. ]

[ This Division also includes portions of Alaska (see *Alaskan Physiographic Areas*) ]

### **Pacific Mountain** *PM*

### 23. Cascade-Sierra Mountains *CM*

- a. Northern Cascade Mountains *NCM*  
[ Sharp alpine summits of accordant height; higher volcanic cones. ]
- b. Middle Cascade Mountains *MCM*  
[ Generally accordant summits; higher volc. cones]
- c. Southern Cascade Mountains *SCM*  
[ Volcanic mountains variously eroded; no very distinct range. ]
- d. Sierra Nevada *SIN*  
[ Block mountain range tilted west; accordant crests; alpine peaks near east side. ]

### 24. Pacific Border Province *PB*

- a. Puget Trough *PUT*  
[ Lowlands of diverse character; in part submerged.]
- b. Olympic Mountains *OLM*  
[ Generally accordant crests; local alpine peaks. ]
- c. Oregon Coast Range *OCR*  
[ Uplifted peneplain on weak rocks, dissected; monadnocks of igneous rock. ]
- d. Klamath Mountains *KLM*  
[Uplifted and dissected peneplain on strong rocks; extensive monadnocks ranges. ]

## Physiographic Regions

**Pacific Mountain** PM  
( continued )

## Physiographic Provinces & Sub-Provinces

- e. California Trough CAT  
[ Low fluvial plain. ]
- f. California Coast Ranges CCR  
[ Parallel ranges and valleys on folded, faulted, and metamorphosed strata; rounded crests of sub-equal height. ]
- g. Los Angeles Ranges LAR  
[ Narrow ranges and broad fault blocks; alluvial lowlands. ]

- 25. Lower California Province LC  
[ Dissected westward-sloping granite upland (in northern part). ]

[ This Division also includes portions of Alaska (see Alaskan Physiographic Areas) ]

## **Alaskan Physiographic Areas** (Warhaftig, 1965)

The following Alaskan-Peninsula physiographic areas are extensions of the preceding North American Physiographic Divisions (e.g., *Rocky Mountain System*). These Alaskan extensions are presented here, rather than intermingled with the previous Division / Province lists because they a) constitute a geographically coherent package (Wahrhaftig, 1965); b) these extensions were not contained within Fenneman's original work which dealt only with the conterminous US (Fenneman, 1931; 1938; & 1946), and c) Wahrhaftig's map-unit numbers are independent of, and inconsistent with Fenneman's. Wahrhaftig's original map unit scheme & numbers are retained here for simplicity in using his map of the Alaskan peninsula. [ *CAUTION*: Wahrhaftig's map-unit numbers should not be confused with similar map-unit numbers from Fenneman's map for the conterminous US. ]

## Physiographic Divisions

**Interior Plains** IN  
( continued )

**Rocky Mountains System**  
RM  
( continued )

## Physiographic Provinces & Sections

- 1. Arctic Coastal Plain Province --
  - a. Teshekpuk Hills section --
  - b. White Hills section --
- 2. Arctic Foothills Province AF
  - a. Northern Section --
  - b. Southern Section --

[ Note: The map-unit numbering sequence shown here is from Wahrhaftig (1965), and is independent of, and not consistent with, that of Fenneman ]

**Physiographic Divisions**

**Physiographic Provinces  
& Sections**

**Intermontane Plateaus** IP  
( continued )

- Arctic Mountains Province AM
  - 3. Delong Mountains section --
  - 4. Noatak Lowlands section --
  - 5. Baird Mountains section --
  - 6. Central & Eastern Brooks Range section -
  - 7. Ambler-Chandalar Ridge & Lowland section --
- Northern Plateaus Province --
  - 8. Porcupine Plateau section --
    - a. Thazzik Mountain
  - 9. Old Crow Plain section -- [ noted but not described ]
  - 10. Olgivie Mountains section --
  - 11. Tintina Valley (Eagle Trough) section --
  - 12. Yukon-Tanana Upland section --
    - a. Western Part
    - b. Eastern Part
  - 13. Northway - Tanacross Lowland section --
  - 14. Yukon Flats section --
  - 15. Rampart Trough section --
  - 16. Kokrine - Hodzana Highlands section --
    - a. Ray Mountains
    - b. Kokrine Mountains
- Western Alaska Province --
  - 17. Kanuti Flats section --
  - 18. Tozitna - Melozitna Lowland section --
  - 19. Indian River Upland section --
  - 20. Pah River Section --
    - a. Lockwood Hills
    - b. Pah River Flats
    - c. Zane Hills
    - d. Purcell Mountains
  - 21. Koyukuk Flats section --
  - 22. Kobuk-Selawik Lowland section --
    - a. Waring Mountains
  - 23. Selawik Hills section --
  - 24. Buckland River Lowland section --
  - 25. Nulato Hills section --
  - 26. Tanana - Kuskowin Lowland section --
  - 27. Nowitna Lowland section --
  - 28. Kuskokwim Mountains section --

[ Note: The map-unit numbering sequence shown here is from Wahrhaftig (1965), and is independent of, and not consistent with, that of Fenneman ]

**Physiographic Divisions**

**Intermontane Plateaus** IP  
( continued )

**Pacific Mountain System**  
PM  
( continued )

**Physiographic Provinces  
& Sections**

- 29. Innoko Lowlands section --
- 30. Nushagak - Big River Hills section --
- 31. Holitna Lowland section --
- 32. Nushagak - Bristol Bay Lowland section --
- 33. Seward Peninsula Province SEP
  - a. Bendeleben Mountains
  - b. Kigluaik Mountains
  - c. York Mountains

Bering Shelf Province BES

- 34. Yukon- Kuskokwim Coastal Lowland section --
  - a. Norton Bay Lowland
- 35. Bering Platform section --
  - a. St. Lawrence Island
  - b. Pribilof Island
  - c. St. Matthew Island
  - d. Nunivak Island

36. Ahklun Mountains Province --

Alaska - Aleutian Province AAC

- 37. Aleutian Islands section --
- 38. Aleutian Range section --
- 39. Alaska Range (Southern Part) section --
- 40. Alaska Range (Central & Eastern Parts) section --
  - a. Mentasta - Nutzotin Mountain segment.
- 41. Northern Foothills of the Alaska Range section --

Coastal Trough Province --

- 42. Cook Inlet - Susitna Lowland section --
- 43. Broad Pass Depression section --
- 44. Talkeetna Mountains section --
  - a. Chulitna Mountains
  - b. Fog Lakes Upland
  - c. Central Talkeetna Mountains
  - d. Clarence Lake Upland
  - e. Southeastern Talkeetna Mountains
- 45. Upper Matanuska Valley section --
- 46. Clearwater Mountains section --
- 47. Gulkana Upland section --

[ Note: The map-unit numbering sequence shown here is from Wahrhaftig (1965), and is independent of, and not consistent with, that of Fenneman ]

**Physiographic Divisions**

**Pacific Mountain System**

*PM*

( continued )

**Physiographic Provinces  
& Sections**

- 48. Copper River Lowland section --
  - a. Eastern Part
  - b. Western Part: Lake Louis Plateau
- 49. Wrangell Mountains section --
- 50. Duke Depression [ not described]
- 51. Chatham Trough section --
- 52. Kupreanof Lowland section --

Pacific Border Ranges Province *PBS*

- 53. Kodiak Mountains section --
- 54. Kenai - Chugach Mountains section --
- 55. St Elias Mountains section --
  - a. Fairweather Range subsection
- 56. Gulf of Alaska Coastal section --
- 57. Chilkat - Baranof Mountains section --
  - a. Alek Ranges subsection
  - b. Glacier Bay subsection
  - c. Chichagof Highland subsection
  - d. Baranof Mountains subsection
- 58. Prince of Whales Mountains section—

Coast Mountains Province *COM*

- 59. Boundary Pass section --
- 60. Coastal Foothills section --

[ Note: The map-unit numbering sequence shown here is from Wahrhaftig (1965), and is independent of, and not consistent with, that of Fenneman ]

**Other Physiographic Areas**

( not addressed by Fenneman, 1946; or Wahrhaftig, 1965 )

**Physiographic Divisions**

**Pacific Rim** *PR*

**Physiographic Provinces  
& Sections**

Pacific Islands Province *PI*

- a. Hawaiian Islands *HAI*
- b. Guam *GUM*
- c. Trust Territories \* *TRT*  
(e.g., Commonwealth of the Northern Mariana Islands, Federated States of Micronesia, Palau, Republic of Marshall Islands, etc.)
- d. Other

\* Most of the former US Trust Territories of the Pacific are now independent nations. This designation is used here solely to aid accessing archived, historical data.



## **PART II: "GEOMORPHIC DESCRIPTION"**

( Complete Choice-Lists, and Topical Subsets )

There are various lists of terms within this section. These lists contain only the preferred "landform"- related terms as defined in the *Glossary of Landform and Geologic Terms*, National Soil Survey Handbook - Part 629 (NRCS, 2017) to encourage the national use of standard terms. Non-landform terms (e.g. geologic materials), undesirable terms (e.g. redundant synonyms, obsolete terms, etc.) retained in the *Glossary* for historical purposes, or legitimate landform terms not recognized in Soil Survey have been omitted from the following lists.

The first portion of Part II presents comprehensive alphabetical lists for Landscapes, Landforms, Microfeatures, and their anthropogenic analogues (Anthroscapes, Anthropogenic Landforms, and Anthropogenic Microfeatures). The second portion of Part II groups related terms into subsets of *Geomorphic Environment* or *Other Groupings* as an aid for locating related terms or appropriate contenders. Most of these subsets are based upon a common process of origin (i.e. a *Geomorphic Environment*). Consequently, if the origin of a landform is known or can be inferred, a "short" list of appropriate terms can be quickly reviewed. One need not search through a long "master" list containing numerous, unrelated terms. **Note:** The lists of terms are neither mutually exclusive nor a rigid hierarchical classification system. Some features occur in more than one Geomorphic Environment (e.g. *beach* occurs in both "Coastal Marine" and "Lacustrine" geomorphic process environments), or occur at more than one scale (e.g. *river valley* can occur either as a "Landscape" or a "Landform"). Generally, terms are found in only one or two Geomorphic Environments.

Surface features (landforms, etc.) are commonly the result of multiple geomorphic processes. In selecting or assigning a landform term to a particular "Geomorphic Environment" list, emphasis is placed upon the dominant, near-surface process(s) evident in the accompanying soils. For example, a *kame* is a landform deposited by glaciofluvial processes and is usually modified by subsequent surficial erosion. The dominant geomorphic processes that determine the sediments present, their arrangement, and their intrinsic attributes relate most strongly to a Glacial Environment, not an *Erosional Grouping* list.

Grouping terms by Geomorphic Environment places the emphasis on the agents, geologic processes, and the materials responsible for the formation internal arrangement and behavior of the landform. For example, a sand dune which occurs on a stream terrace is of eolian origin (the dominant agent is wind); dunes are listed with Eolian landforms. Fluvial processes may have provided the sand from which the dune was constructed and the underlying structure upon which it rests (stream terrace - a Fluvial-process landform), but eolian processes are responsible for the landform of primary pedological interest.

Unfortunately, not all surface features can be adequately grouped by Geomorphic Environment. Therefore, some additional groupings have been included. For example, a group is included for "Depressional" features. Obviously, "Depressional" is not a process per say. The land features in this category share a common attribute (they are all low areas or declivities), but were not all formed by the same processes. The features within each "Other Grouping" share a common setting or context, similar attributes, or land use concerns rather than a common geomorphic origin.

## PART II : GEOMORPHIC DESCRIPTION ( Outline )

### I) COMPREHENSIVE LISTS:

- A) **LANDSCAPES** ( broad or unique groups or clusters of spatially associated features ).
- B) **LANDFORMS** ( discrete, natural, individual features mappable at common survey scales).
- C) **MICROFEATURES** ( discrete, natural, individual features typically too small to delineate at common survey scales ).

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- D) **ANTHROSCAPES** [ large areas, permanently altered (*human-made / extensively modified areas*).
- E) **ANTHROPOGENIC LANDFORMS** [ discrete, artificial (*human-made or extensively modified*), earth surface features ].
- F) **ANTHROPOGENIC MICROFEATURES** [ discrete, artificial (*human-made or extensively modified*), earth surface features readily observable in the field but too small to delineate at common survey scales].

### II) GEOMORPHIC ENVIRONMENTS and OTHER GROUPINGS:

Landscape, Landform, and Microfeature terms grouped by process or common settings.  
Lists are not mutually exclusive: some features occur in more than one grouping.

- 
- |   |  |
|---|--|
| ↑ | 1. <b>Coastal Marine and Estuarine</b> ( wave, tidal, or shallow marine related).      |
| ↑ | 2. <b>Lacustrine</b> (related to inland water bodies).                                 |
| ↑ | 3. <b>Fluvial</b> [related to concentrated channel flow (e.g. stream)].                |
| ↑ | 4. <b>Solution</b> (dominated by dissolution and subsurface drainage).                 |
| ↑ | 5. <b>Eolian</b> (wind dominated).   |
| ↑ | 6. <b>Glacial</b> (directly related to glaciers).                                      |
| ↑ | 7. <b>Periglacial</b> (related to non-glacial, cold climate).                          |
| ↑ | 8. <b>Mass Movement</b> (gravity dominated).   |
| ↑ | 9. <b>Volcanic and Hydrothermal</b>  |
| ↑ | 10. <b>Tectonic and Structural</b> (bedrock structures, crustal movement).             |
| ↑ | 11. <b>Slope</b> (generic slope forms, geometry, or arrangement rather than process).  |
| ↑ | 12. <b>Erosional</b> (dominated by non-channel, non-perennial water erosion).          |
| ↑ | 13. <b>Depressional</b> (low area or declivity terms, excludes permanent water bodies) |
- 
- 25



- 14. **Wetlands** (related to vegetated or shallow wet areas, wet soils).
- 15. **Water Bodies** (permanent water features).
- 16. **Subaqueous Features** [submerged features generally capable of supporting rooted plants (*emergent or subaqueous*), and adjacent features].

## PART II : GEOMORPHIC DESCRIPTION

[ Codes: Conventionally, the entire land-feature term is used (e.g. *dune field* ). Some data storage programs (e.g., NASIS) have shorthand codes. An italicized code follows each term (e.g., *meander belt MB*); shown for historical purposes. ]

### I) COMPREHENSIVE LISTS (Landscapes, Landforms, Microfeatures, and Anthroscapes, Anthrop[ogenic Landforms, Anthropogenic Microfeatures).

#### A) LANDSCAPES (broad and/or unique groups of spatially associated landforms.)

alluvial plain	AP	glaciokarst	GK
alluvial plain remnant	AR	gulf ( <i>water body; also Landform</i> )	GU
badlands	BA	hills ( <i>singular = Landform</i> )	HI
bajada ( <i>also Landform</i> )	BJ	ice-margin complex	IC
barrier island ( <i>also Landform</i> )	BI	intermontane basin ( <i>also Landform</i> )	IB
basin	BS	island ( <i>also Landform</i> )	IS
basin floor ( <i>also Landform</i> )	BC	karst	KP
batholith	BL	kegel karst	KK
bay [coast] ( <i>water body; also LF</i> )	BY	lagoon ( <i>water body; also Landform</i> )	LG
bolson	BO	lake plain ( <i>also Landform</i> )	LP
breached anticline ( <i>also LF</i> )	BD	lava field ( <i>also Landform</i> )	LF
breaklands	BR	lava plain ( <i>also Landform</i> )	LV
breaks ( <i>also Landform</i> )	BK	lava plateau ( <i>also Landform</i> )	LL
caldera ( <i>also Landform</i> )	CD	lowland	LW
canyonlands	CL	marine terrace ( <i>also Landform</i> )	MT
coastal plain ( <i>also Landform</i> )	CP	meander belt	MB
cockpit karst	CPK	mountain range	MR
cone karst	CK	mountains ( <i>singular = Landform</i> )	MO
<b>coppice dune field</b>	<b>CDF</b>	mountain system	MS
continental glacier	CG	ocean ( <i>water body</i> )	OC
delta plain ( <i>also Landform</i> )	DP	outwash plain ( <i>also Landform</i> )	OP
dissected breaklands	DB	peninsula	PE
dissected plateau	DI	piedmont	PI
drumlin field	DF	piedmont slope	PS
dune field ( <i>also Landform</i> )	DU	plains ( <i>also Landform</i> )	PL
estuary ( <i>water body; also Landform</i> )	ES	plateau ( <i>also Landform</i> )	PT
everglades	EG	rift valley	RF
fan piedmont ( <i>also Landform</i> )	FP	river valley ( <i>also Landform</i> )	RV
fault-block mountains	FM	sandhills	SH
fluviokarst	FK	sand plain	SP
fluviomarine terrace( <i>also Landform</i> )	FT	scabland	SC
fold-thrust hills	FTH	sea ( <i>water body; also Landform</i> )	SEA
foothills	FH	semi-bolson	SB

shield volcano <i>(also Landform)</i>	SV	till plain <i>(also Landform)</i>	TP
shore complex	SX	tower karst	TW
sinkhole karst	SK	upland	UP
sound <i>(water body; also Landform)</i>	SO	valley <i>(also Landform)</i>	VA
strait <i>(water body; also Landform)</i>	ST	volcanic field <i>(also Landform)</i>	VF
tableland	TB		
thermokarst	TK		

**B) LANDFORMS** (discrete, natural, earth-surface features mappable at common survey scales).

aa lava flow	ALF	blind valley	VB
alas	AA	block field	BW
alluvial cone	AC	block glide	BLG
alluvial fan	AF	block lava flow	BLF
alluvial flat	AP	block stream	BX
alpine glacier	AG	blowout	BY
anticline	AN	bluff	BN
arete	AR	bog	BO
arroyo	AY	box canyon	BOX
ash field	AQ	braided stream	BZ
ash flow	AS	breaks <i>(also Landscape)</i>	BK
atoll	AT	breached anticline <i>(also Landscape)</i>	BRL
avalanche chute	AL	broad interstream divide	BID
axial stream	AX	butte	BU
back-barrier beach	BBB	caldera <i>(also Landscape)</i>	CD
back-barrier flat	BBF	canyon	CA
backshore	AZ	canyon bench	CYB
backswamp	BS	canyon wall	CW
bajada <i>(also Landscape)</i>	BJ	Carolina Bay	CB
ballena	BL	channel <i>(also Microfeature)</i>	CC
ballon	BV	chenier	CG
bar	BR	chenier plain	CH
barchan dune	BQ	cinder cone	CI
barrier beach	BB	cirque	CQ
barrier beach [relict]	BBR	cirque floor	CFL
barrier cove	BAC	cirque headwall	CHW
barrier flat	BF	cirque platform	CPF
barrier island <i>(also Landscape)</i>	BI	cliff	CJ
basin floor <i>(also Landscape)</i>	BC	climbing dune	CDU
basin-floor remnant	BD	closed depression <i>(also Micro.)</i>	CLD
bay [coast] <i>(water body; also LS)</i>	BAY	coastal plain <i>(also Landscape)</i>	CP
bay [geom.]	BYG	cockpit	COC
bay bottom	BOT	col	CL
bayou <i>(water body)</i>	WC	collapse sinkhole	CSH
beach	BE	collapsed ice-floored lakebed	CK
beach plain	BP	collapsed ice-walled lakebed	CN
beach ridge	BG	collapsed lake plain	CS
beach terrace	BT	collapsed outwash plain	CT
berm	BM	colluvial apron	COA
beveled base	BVB	complex landslide	CLS

coral island	COR	fan	FC
coulee	CE	fan apron	FA
cove [geom.]	CO	fan collar	FOC
cove [water body]	COW	fanhead trench	FF
crag and tail	CAT	fan piedmont <i>(also Landscape)</i>	FG
creep	CRE	fan remnant	FH
crevasse filling	CF	fan skirt	FI
cuesta	CU	fault block	FAB
cuesta valley	CUV	fault-line scarp	FK
cutoff	CV	fault zone	FAZ
debris avalanche	DA	fen	FN
debris fall	DEF	fissure vent	FIV
debris flow	DF	fjord (water body)	FJ
debris slide	DS	flat	FL
debris spread	DES	flatwoods	FLW
debris topple	DET	flood plain	FP
deflation basin	DB	flood-plain playa	FY
deflation flat	DEF	flood-plain splay	FM
delta	DE	flood-plain step	FO
delta plain <i>(also Landscape)</i>	DC	flood-tidal delta	FTD
depression	DP	flood-tidal delta flat	FTF
diapir	DD	flood-tidal delta slope	FTS
diatrema	DT	flow	FLO
dike	DK	flute <i>(also Microfeature)</i>	FU
dip slope	DL	fluviomarine bottom	FMB
disintegration moraine	DM	fluviomarine terrace <i>(also Landscape)</i>	FMT
tributary	DIS	fold	FQ
divide	DN	foredune	FD
dome	DO	fosse	FV
drainageway	DQ	free face <i>(also Geom. Component – Hills, Mountains)</i>	FW
drainhead complex	DRC	fringe-tidal marsh	FTM
draw	DW	gap	GA
drumlin	DR	geyser	GE
drumlinoid ridge	DRR	geyser basin	GEB
dune	DU	geyser cone	GEC
dune field <i>(also Landscape)</i>	DUF	giant ripple	GC
dune lake <i>(water body)</i>	DUL	glacial drainage channel	GD
dune slack <i>(also Microfeature)</i>	DUS	glacial lake <i>(water body)</i>	WE
earthflow	EF	glacial lake [relict]	GL
earth spread	ESP	glacial-valley floor	GVF
earth topple	ETO	glacial-valley wall	GVW
end moraine	EM	glacier	GLA
ephemeral stream <i>(also Micro.)</i>	EPS	gorge	GO
eroded fan remnant	EFR	graben	GR
eroded fan-remnant sideslope	EFS	ground moraine	GM
erosion remnant	ER	gulch	GT
escarpment	ES	gulf <i>(water body; also Landscape)</i>	GU
esker	EK	gut [channel] <i>(water body; also Micro.)</i>	WH
estuarine tidal stream <i>(also Micro)</i>	ETS	gut [valley]	GV
estuary <i>(water body; also Landscape)</i>	WD	half graben	HG
faceted spur	FS	hanging valley	HV
fall <i>(also parent material)</i>	FB	headland	HE
falling dune	FDU		

head-of-outwash	HD	lava field (also Landscape)	LFI
headwall	HW	lava flow	LC
high hill	HH	lava flow unit (also Microfeature)	LFU
highmoor bog	HB	lava plain (also Landscape)	LN
hill (plural = Landscape)	HI	lava plateau (also Landscape)	LL
hillslope	HS	lava trench (also Microfeature)	LTR
hogback	HO	lava tube	LTU
homoclinal ridge	HCR	ledge (also Microfeature)	LE
homocline	HC	levee	LV
horn	HR	loess bluff	LO
horst	HT	loess hill	LQ
hot spring	HP	longitudinal dune	LDU
ice-contact slope	ICS	longshore bar	LON
ice-marginal stream	IMS	longshore bar [relict]	LR
ice pressure ridge	IPR	louderback	LU
ice-pushed ridge	IPU	low hill	LH
inlet	IL	lowmoor bog	LX
inselberg	IN	maar	MAA
inset fan	IF	mainland cove	MAC
interdrumlin	IDR	main scarp (also Microfeature)	MAS
interdune (also Microfeature)	ID	mangrove swamp	MAN
interfluve (also Geom. Component - Hills) IV	IV	marine lake	ML
interior valley	INV	marine terrace (also Landscape)	MT
intermittent stream (also Microfeature)	INT	marsh	MA
intermontane basin (also Landscape)	IB	mawae	MAW
island (also Landscape)	IS	meander	MB
kame	KA	meandering channel	MC
kame moraine	KM	meander scar	MS
kame terrace	KT	meander scroll	MG
karst cone	KC	medial moraine	MH
karstic marine terrace	KMT	mesa	ME
karst lake	KAL	meteorite crater	MEC
karst tower	KTO	mogote	MOG
karst valley	KVA	monadnock	MD
kettle	KE	monocline	MJ
kipuka	KIP	moraine	MU
knob	KN	mountain (plural = Landscape)	MM
knoll	KL	mountain slope	MN
lacolith	LAC	mountain valley	MV
lagoon (water body; also Landscape)	WI	mudflow	MW
lagoon bottom	LBO	mud pot	MP
lagoon channel	LCH	muskeg	MX
lagoon [relict]	LAR	natural levee	NL
lahar	LA	nearshore zone	NZ
lake (water body)	WJ	nearshore zone [relict]	NZR
lakebed	LB	notch	NO
lakebed [relict]	LBR	nunatak	NU
lake plain (also Landscape)	LP	open depression (also Microfeature)	ODE
lakeshore	LF	outwash delta	OD
lake terrace	LT	outwash fan	OF
landslide	LK	outwash plain (also Landscape)	OP
lateral moraine	LM	outwash terrace	OT
lateral spread	LS	overflow stream channel	OSC
lava dome	LD		

oxbow	OX	river valley (also Landscape)	RVV
oxbow lake (water body)	WK	roche moutonnée (also Microfeature)	RN
oxbow lake (ephemeral)	OL	rockfall (also Microfeature)	ROF
paha	PA	rockfall avalanche	RFA
pahoehoe lava flow	PAF	rock glacier	RO
paleoterrace	PTR	rock pediment	ROP
parabolic dune	PB	rock spread	ROS
parna dune	PD	rock topple	ROT
partial ballena	PF	rotational debris slide	RDS
patterned ground	PG	rotational earth slide	RES
pavement karst	PAV	rotational rock slide	RRS
peak	PK	rotational slide	RTS
peat plateau	PJ	sabkha	ABS
pediment	PE	saddle	SA
perennial stream (water body)	PS	sag (also Microfeature)	SAG
pillow lava flow	PIF	sag pond (water body, also Micro.)	SGP
pingo	PI	salt marsh	SM
pinnacle	PIN	salt pond (water body; also Micro.)	WQ
pitted outwash plain	PM	sand flow	RW
pitted outwash terrace	POT	sand ramp	SAR
plain (also Landscape)	PN	sand sheet	RX
plateau (also Landscape)	PT	scarp	RY
playa	PL	scarp slope	RS
playa dune (also Microfeature)	PDU	scree slope	SCS
playa floor (also Microfeature)	PFL	sea (water body; also Landscape)	SEA
playa lake (water body)	WL	sea cliff	RZ
playa rim (also Microfeature)	PRI	seep (also Microfeature)	SEE
playa slope (also Microfeature)	PSL	seif dune	SD
playa step (also Microfeature)	PST	semi-open depression (also Micro)	SOD
plug [volcanic]	VOP	shield volcano (also Landscape)	SHV
plug dome	PP	shoal (water body)	WR
pluvial lake (water body)	PLL	shoal (relict)	SE
pluvial lake (relict)	PQ	shore	SHO
pocosin	PO	shore complex	SHC
point bar	PR	sill	RT
point bar [coastal]	PRC	sinkhole	SH
pothole (also Microfeature)	PH	slackwater (water body)	WS
pothole lake (water body)	WN	slickrock (also Microfeature)	SLK
proglacial lake (water body)	WO	slide	SJ
proglacial lake [relict]	PGL	slot canyon	LCS
pyroclastic flow	PCF	slough	SL
pyroclastic surge	PCS	slump block	SN
raised beach	RA	snowfield	SNF
raised bog	RB	soil fall	SOF
ravine	RV	solution platform	SOP
recessional moraine	RM	solution sinkhole	SOS
reef	RF	sound (water body; also Landscape)	SO
ribbed fen	RG	spit	SP
ridge	RI	spur	SQ
rim	RJ	stack [coast]	SRC
rise (also Microfeature; also Geom. Component – Flat plains)	RIS	stack [geom]	SR
river (water body)	RIV	star dune	SDU
		steptoe	ST
		stock	STK

stoss and lee	SAL	underfit stream	US
strait ( <i>water body; also Landscape</i> )	STT	U-shaped valley	UV
strand plain	SS	valley ( <i>also Landscape</i> )	VA
strath terrace	SU	valley border surfaces	VBS
stratovolcano	SV	valley flat	VF
stream ( <i>water body</i> )	STR	valley floor	VL
stream terrace	SX	valley-floor remnant	VFR
strike valley	STV	valley side	VS
string bog	SY	valley train	VT
structural bench	SB	volcanic cone	VC
submerged back-barrier beach	SBB	volcanic crater	CR
submerged mainland beach	SMB	volcanic dome	VD
submerged point bar [coastal]	SPB	volcanic field ( <i>also Landscape</i> )	VOF
submerged-upland tidal marsh	STM	volcanic neck	VON
submerged wave-built terrace	SWT	volcanic pressure ridge	PU
submerged wave-cut platform	SWP	volcano	VO
swale ( <i>also Microfeature</i> )	SC	V-shaped valley	V V
swallow hole	TB	wash	WA
swamp	SW	washover fan	WF
syncline	SZ	washover-fan flat	WFF
talus cone	TC	washover-fan slope	WFS
talus slope	TAS	water-lain moraine	WM
tarn ( <i>water body; also Microfeature</i> )	TAR	wave-built terrace	WT
terminal moraine	TA	wave-cut platform	WP
terrace	TE	wave-worked till plain	WW
terrace remnant	TER	wind gap	WG
thermokarst depression	TK	window	WIN
thermokarst lake ( <i>water body</i> )	W V	<i>wind-tidal flat</i>	WTF
tidal flat	TF	yardang ( <i>also Microfeature</i> )	YD
tidal inlet	T I	yardang trough ( <i>also Microfeature</i> )	YDT
tidal inlet [relict] ( <i>water body</i> )	TIR		
tidal marsh	TM		
till-floored lake plain	TLP		
till plain ( <i>also Landscape</i> )	TP		
toe ( <i>also Microfeature</i> )	TOE		
tombolo	TO		
topple	TOP		
tor	TQ		
Toreva block	TOR		
translational debris slide	TDS		
translational earth slide	TES		
translational rock slide	TRS		
translational slide	TS		
transverse dune	TD		
trough	TR		
tunnel valley	TV		
tunnel-valley lake ( <i>water body</i> )	TVL		

**C) MICROFEATURES** (discrete, natural, earth-surface features typically too small to delineate at common survey scales).

**1) Common Microfeatures** (not used in association with the Landform "Patterned Ground").

bar	BA	playette	PL
channel (also Landform)	CH	pond (water body)	PON
closed depression (also Landform)	CD	pool (water body)	POO
corda	CO	pothole (also Landform)	PH
cutbank	CTB	rib	RB
cutter	CU	rill	RL
dune slack (also Landform)	DS	ripple mark	RM
dune traces	DT	rise (also Landform; also Geom. Component – Flat Plains)	RIS
earth pillar	EP	rockfall (also Landform)	ROF
ephemeral stream (also Landform)	ES	roche moutonnée (also Landform)	POC
estuarine tidal stream (also Landform)	ETS	sag (also Landform)	SAG
finger ridge	FR	sag pond (water body; also Landform)	SP
flute (also Landform)	FL	salt pond (water body; also Landform)	WQ
frost boil	FB	sand boil	SB
glacial groove	GG	seep (also Landform)	SE
groove	GR-	shoreline	SH
gully	GU	shrub-coppice dune	SCD
gut [channel] (also Landform)	WH	slickrock (also Landform)	SLK
hillock	HI	slip face	SF
hoodoo	HO	solifluction lobe	SOL
ice wedge	IWD	solifluction sheet	SS
ice wedge cast	IWC	solifluction terrace	ST
interdune (also Landform)	ID	solution chimney	SCH
intermittent stream (water; also LF)	INT	solution corridor	SCO
karren	KA	solution fissure	SOF
lava flow unit (also Landform)	LFU	solution pipe	SOP
lava trench (also Landform)	LT	spatter cone	SPC
ledge (also Landform)	LE	spiracle	SPI
main scarp (also Landform)	MAS	strandline	SL
minor scarp	MIS	swale (also Landform)	SW
mound	MO	swash zone	SZ
nivation hollow	NH	tank (water body)	TA
open depression (also Landform)	OP	tarn (water body; also Landform)	TN
perennial stream (water body; also LF)	PS	terraces	TER
pinnacle	PI	toe (also Landform)	TOE
playa dune (also Landform)	PD	tree-tip mound	TTM
playa floor (also Landform)	PF	tree-tip pit	TTP
playa rim (also Landform)	PR	tumulus (tumuli = plural)	TU
playa slope (also Landform)	PSL	vernal pool (seasonal water)	VP
playa step (also Landform)	PST	volcanic pressure ridge	VPR
		yardang (also Landform)	YD
		yardang trough (also Landform)	YDT
		zibar	ZB

2) **Periglacial “patterned ground” Microfeatures:** [Singular forms (e.g. *circle*) are used for a single feature (pedon scale) whereas plural forms (e.g. *circles*) are used for map unit components].

circle	<i>CI</i>	palsa (= <i>peat hummock</i> )	<i>PA</i>
earth hummock	<i>EH</i>	polygon	<i>PYG</i>
high-center polygon	<i>HCP</i>	sorted circle	<i>SCI</i>
ice wedge polygon	<i>IWP</i>	stripe	<i>STR</i>
low-center polygon	<i>LCP</i>	turf hummock	<i>TH</i>
nonsorted circle	<i>NSC</i>		

3) **Other “patterned ground” Microfeatures:** [Singular forms (e.g. *hummock*) are used for a single feature (pedon scale) whereas plural forms (e.g. *hummocks*) are used for map unit components].

bar and channel	<i>BC</i>	linear gilgai	<i>LG</i>
circular gilgai	<i>CG</i>	mima mound	<i>MM</i>
elliptical gilgai	<i>EG</i>	pimple mound	<i>PM</i>
gilgai	<i>GI</i>	puff	<i>PU</i>
hummock	<i>HU</i>		

D) **ANTHROSCAPES** [large, discrete areas of artificial (human-made or extensively modified) “landscapes”].

anthroscape	<i>ANT</i>	suburban anthroscape	<i>SAT</i>
agricultural anthroscape	<i>AGT</i>	urban anthroscape	<i>UAT</i>
hillslope terrace anthroscape	<i>HAT</i>		
reclaimed mineland anthroscape	<i>RCT</i>		

resource extraction anthroscape  
*RXT*

E) **ANTHROPOGENIC LANDFORMS** [discrete, artificial (human-made or extensively modified), earth surface features].

artificial collapsed depression	<i>ACD</i>	dump	<i>DU</i>
artificial levee ( <i>also Anthro Micro</i> )	<i>AL</i>	fill	<i>FI</i>
bioswale ( <i>also Anthro Micro</i> )	<i>BS</i>	filled marshland ( <i>also Anthro Micro</i> )	<i>FM</i>
borrow pit ( <i>also Anth Micro</i> )	<i>BP</i>	floodway	<i>FW</i>
burial mound ( <i>also Anth Micro</i> )	<i>BM</i>	gravel pit ( <i>also Anthro Micro</i> )	<i>GP</i>
conservation terrace ( <i>modern</i> )	<i>CT</i>	headwall ( <i>anthro</i> ) ( <i>also Anthro Micro</i> )	<i>HW</i>
cut ( <i>railroad, etc.</i> )	<i>CUT</i>	hillslope terrace ( <i>ancient</i> )	<i>HT</i>
cutbank	<i>CB</i>	landfill ( <i>see sanitary landfill</i> )	--
dredge-deposit shoal	<i>DDS</i>	leveled land	<i>LVL</i>
dredge spoil bank	<i>DSB</i>	midden ( <i>also Anthro Micro</i> )	<i>MI</i>
dredged channel ( <i>also Anthro Micro</i> )	<i>DC</i>	openpit mine	<i>OM</i>
		polder	<i>POL</i>
		quarry	<i>QU</i>

railroad bed	RRB	scalped area (also Anthro Micro)	SA
reclaimed land	RL	sewage lagoon	SWL
rice paddy (also Anthro Micro)	RP	spoil bank (also Anthro Micro)	SB
road bed	RB	spoil pile (also Anthro Micro)	SPP
sand pit	SP	surface mine	SM
sanitary landfill	SL	truncated soil (also Anthro Micro)	TS

**F) ANTHROPOGENIC MICROFEATURES** [discrete, artificial (human-made or extensively modified), earth surface features too small to delineate at normal mapping scales].

artificial levee	AL	headwall [anthro] (also Anth LF)	HW
beveled cut	BC	hillslope terrace (ancient)	HT
bioswale (also Anthro LF)	BS	impact crater	IC
borrow pit	BP	interfurrow	IF
burial mound (also Anthro LF)	BM	log landing	LL
conservation terrace (modern)	CT	midden (also Anthro LF)	MI
cut (railroad, etc.)	CUT	pond (human-made)	PO
cutbank	CB	railroad bed	RRB
ditch	DI	reclaimed land	RL
double-bedding mound (i.e. bedding mound for timber; Lower Coastal Plain)	DBM	rice paddy (also Anthro LF)	RP
drainage ditch	DD	road bed	RB
dredged channel (also Anthro LF)	DC	road cut	RC
fill	FI	sand pit	SP
filled marshland (also Anth LF)	FM	scalped area (also Anthro LF)	SA
floodway	FW	sewage lagoon	SWL
furrow	FR	skid trail	ST
gravel pit (also Anthro LF)	GP	spoil bank (also Anthro LF)	SB
		spoil pile (also Anthro LF)	SPP
		tillage mound	TM
		truncated soil (also Anthro LF)	TS

**II) GEOMORPHIC PROCESS or OTHER GROUPINGS** (Landscape, Landform, and Microfeature terms grouped by "geomorphic process" (e.g. *Fluvia*) or geomorphic setting (e.g. *Water Bodies*). Lists are not mutually exclusive; some terms occur in multiple groups.)

**1. COASTAL MARINE AND ESTUARINE** [Wave or tidal control or near-shore / shallow submarine].

*Landscapes:*

barrier island	<i>BI</i>	lowland	<i>LL</i>
bay [coast] ( <i>water body; also Landform</i> )	<i>BY</i>	marine terrace ( <i>also Landform</i> )	<i>MT</i>
coastal plain ( <i>also Landform</i> )	<i>CP</i>	ocean	<i>OC</i>
delta plain	<i>DP</i>	peninsula	<i>PE</i>
estuary ( <i>water body; also Landform</i> )	<i>ES</i>	sea ( <i>water body; also Landform</i> )	<i>SEA</i>
gulf ( <i>water body; also Landform</i> )	<i>GU</i>	shore complex	<i>SX</i>
fluviomarine terrace ( <i>also Landform</i> )	<i>FT</i>	sound ( <i>water body; also Landform</i> )	<i>SO</i>
island ( <i>also Landform</i> )	<i>IS</i>	strait ( <i>water body; also Landform</i> )	<i>ST</i>
lagoon ( <i>water body; also Landform</i> )	<i>LG</i>		

*Landforms:*

atoll	<i>AT</i>	flatwoods	<i>FLW</i>
back-barrier beach	<i>BBB</i>	fluviomarine terrace ( <i>also LS</i> )	<i>FMT</i>
back-barrier flat	<i>BBF</i>	foredune	<i>FD</i>
backshore	<i>AZ</i>	fringe-tidal marsh	<i>FTM</i>
bar	<i>BR</i>	gulf ( <i>water body; also Landscape</i> )	<i>GU</i>
barrier beach	<i>BB</i>	gut [channel] ( <i>water body; also Microfeature</i> )	<i>WH</i>
barrier cove	<i>BAC</i>	headland	<i>HE</i>
barrier flat	<i>BF</i>	island ( <i>also Landscape</i> )	<i>IS</i>
barrier island ( <i>also Landscape</i> )	<i>BI</i>	lagoon ( <i>water body; also Landscape</i> )	<i>WI</i>
bay [coast] ( <i>water body; also LS</i> )	<i>WB</i>	lagoon [relict]	<i>LAR</i>
bay bottom	<i>BOT</i>	longshore bar	<i>LON</i>
beach	<i>BE</i>	longshore bar [relict]	<i>LR</i>
beach plain	<i>BP</i>	mangrove swamp	<i>MAN</i>
beach ridge	<i>BG</i>	marine lake ( <i>water body</i> )	<i>ML</i>
beach terrace	<i>BT</i>	marine terrace ( <i>also Landscape</i> )	<i>MT</i>
berm	<i>BM</i>	nearshore zone	<i>NZ</i>
bluff	<i>BN</i>	nearshore zone [relict]	<i>NZC</i>
chenier	<i>CG</i>	point bar [coastal]	<i>PRC</i>
chenier plain	<i>CH</i>	raised beach	<i>RA</i>
coastal plain ( <i>also Landscape</i> )	<i>CP</i>	reef	<i>RF</i>
coral island	<i>COR</i>	rise ( <i>also Microfeature</i> )	<i>RIS</i>
cove [water]	<i>COW</i>	sabkha	<i>SAB</i>
delta	<i>DE</i>	salt marsh	<i>SM</i>
delta plain ( <i>also Landscape</i> )	<i>DC</i>	sea ( <i>water body; also Landscape</i> )	<i>SEA</i>
drainhead complex	<i>DRC</i>	sea cliff	<i>RZ</i>
estuary ( <i>also Landscape</i> )	<i>WD</i>	semi-open depression	<i>SOD</i>
estuarine tidal stream ( <i>also Micro</i> )	<i>ETS</i>		
flat	<i>FL</i>		

shoal (relict)	SE	tidal flat	TF
shore	SHO	tidal inlet	TI
shore complex <i>(also Landscape)</i>	SHC	tidal inlet [relict]	TIR
sound <i>(water body; also Landscape)</i>	SO	tidal marsh	TM
spit	SP	tombolo	TO
stack [coast]	SRC	washover fan	WF
strait <i>(water body; also Landscape)</i>	STT	wave-built terrace	WT
strand plain	SS	wave-cut platform	WP
submerged-upland tidal marsh	STM	wind-tidal flat	WTF

*Microfeatures:*

gut [channel] <i>(water body; also LF)</i>	WH	shoreline	SH
ripple mark	RM	swash zone	SZ
rise (also Landform)	RIS		

## 2. LACUSTRINE [Related to inland water bodies].

### Landscapes:

bay [coast] ( <i>water body; also LF</i> )	BY	lake plain ( <i>also Landform</i> )	LP
delta plain ( <i>also Landform</i> )	DP	peninsula	PE
island ( <i>also Landform</i> )	IS	shore complex	SX

### Landforms:

backshore	AZ	longshore bar	LON
bar ( <i>also Microfeature</i> )	BR	longshore bar [relict]	LR
barrier beach	BB	nearshore zone	NZ
barrier flat	BF	nearshore zone [relict]	NZR
barrier island	BI	oxbow lake	WK
bay [coast] ( <i>water body; also Landform</i> )	BAY	playa	PL
beach	BE	playa floor ( <i>also Microfeature</i> )	PFL
beach plain	BP	playa lake ( <i>water body</i> )	PLL
beach ridge	BG	playa rim ( <i>also Microfeature</i> )	PRI
beach terrace	BT	playa slope ( <i>also Microfeature</i> )	PSL
berm	BM	playa step ( <i>also Microfeature</i> )	PST
bluff	BN	pluvial lake ( <i>water body</i> )	PLL
delta	DE	pluvial lake (relict)	PQ
delta plain ( <i>also Landscape</i> )	DC	raised beach	RA
flat	FL	sabkha	SAB
flood-plain playa	FY	salt marsh	SM
foredune	FD	shoal [relict]	SE
headland	HE	shore	SHO
island ( <i>also Landscape</i> )	IS	shore complex ( <i>also Landscape</i> )	SHC
karst lake	KAL	spit	SP
lagoon	WI	stack [coast]	SRC
lagoon [relict]	LAR	strand plain	SS
lake ( <i>water body</i> )	WJ	till-floored lake plain	TLP
lakebed ( <i>water body</i> )	LB	tombolo	TO
lakebed [relict]	LB	water-lain moraine	WM
lake plain ( <i>also Landscape</i> )	LP	wave-built terrace	WT
lakeshore	LF	wave-cut platform	WP
lake terrace	LT	wave-worked till plain	WW

### Microfeatures:

bar	BA	ripple mark	RM
playa floor ( <i>also Landform</i> )	PF	shoreline	SH
playa rim ( <i>also Landform</i> )	PR	strandline	SL
playa slope ( <i>also Landform</i> )	PSL	swash zone	SZ
playa step ( <i>also Landform</i> )	PST	vernal pool	VP
playette	PL		

**3. FLUVIAL** [Dominantly related to concentrated water flow (channel flow); includes erosional and depositional features, but excludes glaciofluvial landforms (see *Glacial*) and permanent water features (e.g. river; see *Water Bodies*)].

*Landscapes:*

alluvial plain	AP	delta plain ( <i>also Landform</i> )	DP
alluvial plain remnant	AR	dissected breaklands	DB
badlands	BA	fan piedmont	FP
bajada ( <i>also Landform</i> )	BJ	meander belt	MB
breaklands	BR	river valley ( <i>also Landform</i> )	RV
breaks	BK	scabland	SC
canyonlands	CL		

*Landforms:*

alluvial cone	AC	flood-plain step	FO
alluvial fan	AF	giant ripple	GC
alluvial flat	AP	gorge	GO
arroyo	AY	gulch	GT
axial stream ( <i>water body</i> )	AX	gut [valley]	GV
backswamp	BS	inset fan	IF
bajada ( <i>also Landscape</i> )	BJ	intermittent stream ( <i>also Micro.</i> )	INT
bar ( <i>also Microfeature</i> )	BR	levee	LV
basin-floor remnant	BD	meandering channel	MC
block stream	BX	meander scar	MS
box canyon	BOX	meander scroll	MG
braided stream	BZ	natural levee	NL
canyon	CA	overflow stream channel	OSC
channel	CC	oxbow	OX
coulee	CE	oxbow lake ( <i>water body</i> )	WK
cutoff	CV	paleoterrace	PTR
delta	DE	point bar	PR
delta plain ( <i>also Landscape</i> )	DC	ravine	RV
drainageway	DQ	river valley ( <i>also Landscape</i> )	RVV
drainhead complex	DRC	semi-open depression	SOD
draw	DW	slot canyon	SLC
ephemeral stream ( <i>also Micro</i> )	EPS	strath terrace	SU
fan apron	FA	stream terrace	SX
fan collar	FCO	terrace remnant	TER
fanhead trench	FF	valley border surfaces	VBS
fan remnant	FH	valley flat	VF
fan skirt	FI	valley floor remnant	VFR
flood plain	FP	wash	WA
flood-plain playa	FY	wind gap	WG
flood-plain splay	FM		

*Microfeatures:*

bar	BA	gully	GU
bar & channel ( <i>patterned ground</i> )	BC	intermittent stream ( <i>also Landform</i> )	INT
channel	CH	ripple mark	RM
ephemeral stream ( <i>also LF</i> )	ES	swash zone	SZ
groove	GR		

**4. SOLUTION** [Dominated by dissolution, and commonly, subsurface drainage].

*Landscapes:*

cockpit karst	CPK	kegel karst	KK
cone karst	CK	sinkhole karst	SK
fluviokarst	FK	thermokarst	TK
glaciokarst	GK	tower karst	TW
karst	KR		

*Landforms:*

blind valley	VB	pavement karst	PAV
cockpit	COC	pinnacle	PIN
collapse sinkhole	CSH	sinkhole	SH
interior valley	INV	solution platform	SOP
karst cone	KC	solution sinkhole	SOS
karstic marine terrace	KMT	swallow hole	TB
karst lake	KAL	thermokarst depression ( <i>also</i>	TK
karst tower	KTO	<i>Microfeature</i> )	
karst valley	KVA	yardang ( <i>also Microfeature</i> )	YD
mogote	MOG	yardang trough ( <i>also Microfeature</i> )	YDT

*Microfeatures:*

cutter	CU	solution pipe	SOP
karren	KA	thermokarst depression ( <i>also</i>	TK
solution chimney	SCH	<i>Landform</i> )	
solution corridor	SO	yardang ( <i>also Landform</i> )	YD
solution fissure	SOF	yardang trough ( <i>also Landform</i> )	YDT

**5. EOLIAN** [Dominantly wind related; erosion or deposition].

*Landscapes:*

<b>coppice dune field</b>	<b>CDF</b>	sandhills	<b>SH</b>
dune field <i>(also Landform)</i>	<b>CK</b>	sand plain	<b>SP</b>

*Landforms:*

barchan dune	<b>BQ</b>	paha	<b>PA</b>
blowout	<b>BY</b>	parabolic dune	<b>PB</b>
climbing dune	<b>CDU</b>	parna dune	<b>PD</b>
deflation basin	<b>DB</b>	playa dune <i>(also Microfeature)</i>	<b>PDU</b>
deflation flat	<b>DFL</b>	rise <i>(also Microfeature)</i>	<b>RIS</b>
dune	<b>DU</b>	sabkha	<b>SAB</b>
dune field <i>(also Landscape)</i>	<b>DUF</b>	sand ramp	<b>SAR</b>
dune lake <i>(water body)</i>	<b>DUL</b>	sand sheet	<b>RX</b>
dune slack <i>(also Microfeature)</i>	<b>DUS</b>	seif dune	<b>SD</b>
falling dune	<b>FDU</b>	slickrock <i>(also Microfeature)</i>	<b>SLK</b>
foredune	<b>FD</b>	star dune	<b>SDU</b>
interdune <i>(also Microfeature)</i>	<b>ID</b>	transverse dune	<b>TD</b>
loess bluff	<b>LO</b>	yardang <i>(also Microfeature)</i>	<b>TD</b>
loess hill	<b>LQ</b>	yardang trough <i>(also Microfeature)</i>	<b>YDT</b>
longitudinal dune	<b>LDU</b>		

*Microfeatures:*

dune slack <i>(also Landform)</i>	<b>DS</b>	shrub-coppice dune	<b>SCD</b>
dune traces	<b>DT</b>	slickrock <i>(also Landform)</i>	<b>SLK</b>
interdune <i>(also Landform)</i>	<b>ID</b>	slip face	<b>SF</b>
playa dune <i>(also Landform)</i>	<b>PD</b>	yardang <i>(also Landform)</i>	<b>YD</b>
playette	<b>PL</b>	yardang trough <i>(also Landform)</i>	<b>YDT</b>
rise <i>(also Landform)</i>	<b>RIS</b>	zibar	<b>ZB</b>

**6. GLACIAL** [Directly related to glaciers; includes glaciofluvial, glaciolacustrine, glaciomarine and outwash features].

*Landscapes:*

continental glacier	CG	ice-margin complex	IC
drumlin field	DF	outwash plain <i>(also Landform)</i>	OP
glaciokarst	GK	till plain <i>(also Landform)</i>	TP
hills	HI		

*Landforms:*

alpine glacier	AG	kame moraine	KM
arete	AR	kame terrace	KT
cirque	CQ	kettle	KE
cirque floor	CFL	lateral moraine	LM
cirque headwall	CHW	medial moraine	MH
cirque platform	CPF	moraine	MU
col	CL	nearshore zone	NZ
collapsed ice-floored lakebed	CK	nearshore zone [relict]	NZR
collapsed ice-walled lakebed	CN	nunatak	NU
collapsed lake plain	CS	outwash delta	OD
collapsed outwash plain	CT	outwash fan	OF
crag and tail	CAT	outwash plain <i>(also Landscape)</i>	OP
crevasse filling	CF	outwash terrace	OT
disintegration moraine	DM	paha	PA
drumlin	DR	pitted outwash plain	PM
drumlinoid ridge	DR	pitted outwash terrace	POT
end moraine	EM	pothole <i>(also Microfeature)</i>	PH
esker	EK	pothole lake	WN
fjord <i>(water body)</i>	FJ	proglacial lake <i>(water body)</i>	WO
flute <i>(also Microfeature)</i>	FU	proglacial lake [relict]	PGL
fosse	FV	recessional moraine	RM
giant ripple	GC	roche moutonnée <i>(also Micro.)</i>	RN
glacial drainage channel	GD	rock glacier	RO
glacial lake <i>(water body)</i>	WE	snowfield	SNF
glacial lake [relict]	GL	stoss and lee	SAL
glacial-valley floor	GVF	swale <i>(also Microfeature)</i>	SC
glacial-valley wall	GVW	tarn <i>(water body; also Microfeature)</i>	TAR
glacier	GLA	terminal moraine	TA
ground moraine	GM	till-floored lake plain	TLP
hanging valley	HV	till plain <i>(also Landscape)</i>	TP
head-of-outwash	HD	tunnel valley	TV
ice-contact slope	CS	tunnel-valley lake <i>(water body)</i>	TVL
ice-marginal stream <i>(water body)</i>	IMS	underfit stream	US
ice pressure ridge	IPR	U - shaped valley	UV
ice-pushed ridge	IPU	valley train	VT
interdrumlin	IDR	water-lain moraine	WM
kame	KA	wave-worked till plain	WW

*Microfeatures:*

glacial groove	GG	pothole ( <i>also Landform</i> )	PH
flute ( <i>also Landform</i> )	FL	rise ( <i>also Landform</i> )	RSI
ice wedge	IWD	roche moutonnée ( <i>also Landform</i> )	POC
ice wedge cast	IWC	swale ( <i>also Landform</i> )	SW
nivation hollow	NH	tarn ( <i>water body; also Landform</i> )	TN

**7. PERIGLACIAL** [Related to non-glacial, cold climate (modern or relict), and 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)	CP	plains	PL
hills	HI	thermokarst	TK

*Landforms:*

alas	AA	pingo	PI
block field	BW	rock glacier	RO
muskeg	MX	string bog	SY
patterned ground	PG	thermokarst depression (also	
(see Microfeatures below for types)		Microfeatures)	TK
peat plateau	PJ	thermokarst lake (water body)	WV

*Microfeatures:*

circle	CI	polygon	PYG
earth hummock	EH	solifluction lobe	SOL
frost boil	FB	solifluction sheet	SS
high-center polygon	HCP	solifluction terrace	ST
ice wedge	IWD	sorted circle	SCI
ice wedge cast	IWC	stripe	STR
ice wedge polygon	IWP	thermokarst depression (also LF)	TK
low-center polygon	LCP	turf hummock	TH
nivation hollow	NH		
non-sorted circle	NSC		
palsa (palsen = plural ; = peat hummocks)	PA		

**8. MASS MOVEMENT (= MASS WASTING)** [Dominated by gravity, including “creep” forms; see Mass Movement Types table].

*Landscapes: These generic “Landscapes” are not Mass Movement features per say, but are commonly modified by, and include localized areas of, Mass Movement.*

breaklands	BR	hills	HI
dissected breaklands	DB	mountain range	MR
foothills	FH	mountains	MO

*Landforms:*

ash flow	AS	rockfall <i>(also Microfeature)</i>	ROF
avalanche chute	AL	rockfall avalanche	RFA
block glide	BLG	rock spread	ROS
block stream	BX	rock topple	ROT
colluvial apron	COA	rotational debris slide	RDA
complex landslide	CLS	rotational earth slide	RES
creep	CRE	rotational rock slide	RRS
debris avalanche	DA	rotational slide	RTS
debris fall	DEF	sag <i>(also Microfeature)</i>	SAG
debris flow	DF	sag pond <i>(water body; also Micro)</i>	SGP
debris slide	DS	sand flow	RW
debris spread	DES	scree slope	SCS
debris topple	DET	slide	SJ
earthflow	EF	slump block	SN
earth spread	ESP	soil fall	SOF
earth topple	ETO	talus cone	TC
fall	FB	talus slope	TAS
flow	FLO	toe <i>(also Microfeature)</i>	TOE
lahar	LA	topple	TOP
landslide	LK	Toreva block	TOR
lateral spread	LS	translational debris slide	TDS
main scarp <i>(also Microfeature)</i>	MAS	translational earth slide	TES
mudflow	MW	translational rock slide	TRS
rock glacier	RO	translational slide	TS

*Microfeatures:*

main scarp <i>(also Landform)</i>	MAS	solifluction lobe	SOL
minor scarp	MIS	solifluction sheet	SS
rockfall <i>(also Landform)</i>	ROF	solifluction terrace	ST
sag <i>(also Landform)</i>	SAG	terraces	TER
sag pond <i>(water body; also LF)</i>	SP	toe <i>(also Landform)</i>	TOE
sand boil	SB		

## 9. VOLCANIC and HYDROTHERMAL

### Landscapes:

caldera (also Landform)	CD	lava plateau (also Landform)	LL
foothills	FH	mountains	MO
hills	HI	shield volcano (also Landform)	SV
lava field (also Landform)	LF	volcanic field (also Landform)	VF
lava plain (also Landform)	LV		

### Landforms:

<b>aa</b> lava flow	ALF	lava tube	LTU
ash field	AQ	louderback	LU
ash flow	AS	maar	MAA
block lava flow	BLF	mawae	MAW
caldera (also Landscape)	CD	mud pot	MP
cinder cone	CI	pahoehoe lava flow	PAF
diatreme	DT	pillow lava flow	PIF
dike	DK	plug dome	PP
fissure vent	FIV	pyroclastic flow	PCF
geyser	GE	pyroclastic surge	PCS
geyser basin	GEB	shield volcano (also Landform)	SHV
geyser cone	GEC	steptoe	ST
hot spring	HP	stratovolcano	SV
kipuka	KIP	volcanic cone	VC
lahar	LA	volcanic crater	CR
lava dome	LD	volcanic dome	VD
lava field (also Landscape)	LFI	volcanic field (also Landscape)	VOF
lava flow	LC	volcanic neck	VON
lava flow unit (also Microfeature)	LFU	volcanic pressure ridge (also Microfeature)	PU
lava plain (also Landscape)	LN	volcano	VO
lava plateau (also Landscape)	LL		
lava trench (also Microfeature)	LTR		

### Microfeatures:

corda	CO	spiracle	SPI
lava flow unit (also Landform)	LFU	tumulus (tumuli = plural)	TU
lava trench (also Landform)	LT	volcanic pressure ridge (also LF)	VPR
spatter cone	SPC		

**10. TECTONIC and STRUCTURAL** [Related to regional and local bedrock structures, or crustal movement. In Soil Survey, structural and tectonic features are only recognized if they have some expression at or near the land surface].

*Landscapes:*

basin floor	<i>BC</i>	intermontane basin	<i>IB</i>
batholith	<i>BL</i>	mountain range	<i>MR</i>
bolson	<i>BO</i>	mountains	<i>MO</i>
breached anticline ( <i>also Landform</i> )	<i>BD</i>	mountain system	<i>MS</i>
dissected plateau	<i>DP</i>	piedmont slope	<i>PS</i>
fault-block mountains	<i>FM</i>	plateau	<i>PT</i>
fold-thrust hills	<i>FTH</i>	rift valley	<i>RF</i>
foothills	<i>FH</i>	semi-bolson	<i>SB</i>
hills	<i>HI</i>	tableland	<i>TB</i>
		valley	<i>VA</i>

*Landforms:*

anticline	<i>AN</i>	half graben	<i>HG</i>
breached anticline ( <i>also LS</i> )	<i>BRL</i>	hogback	<i>HO</i>
canyon bench	<i>CYB</i>	homoclinal ridge	<i>HCR</i>
cuesta	<i>CU</i>	horst	<i>HT</i>
cuesta valley	<i>CUV</i>	louderback	<i>LU</i>
diapir	<i>DD</i>	meteorite crater	<i>MEC</i>
dike	<i>DK</i>	monocline	<i>MJ</i>
dip slope	<i>DL</i>	scarp slope	<i>RS</i>
dome	<i>DO</i>	sill	<i>RT</i>
fault block	<i>FAB</i>	stock	<i>STK</i>
fault-line scarp	<i>FK</i>	strike valley	<i>STV</i>
fault zone	<i>FAZ</i>	structural bench	<i>SB</i>
fold	<i>FQ</i>	syncline	<i>SZ</i>
graben	<i>GR</i>	window	<i>WIN</i>

*Microfeatures:*

sand boil	<i>SB</i>
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**11. SLOPE** [Generic terms (e.g. hill) or those that describe slope form, geometry, or arrangement of land features, rather than any particular genesis or process].

*Landscapes:*

badlands	BA	mountain range	MR
breached anticline ( <i>also LF</i> )	BD	mountains	MO
breaklands	BR	mountain system	MS
breaks	BK	piedmont	PI
canyonlands	CL	piedmont slope	PS
dissected breaklands	DB	plains ( <i>singular = LF</i> )	PL
dissected plateau	DI	plateau ( <i>also Landform</i> )	PT
fault-block mountains	FM	tableland	TB
foothills	FH	upland	UP
hills	HI		

*Landforms:*

beveled base	BVB	low hill	LL
block stream	BX	mesa	ME
bluff	BN	mountain ( <i>plural = Landscape</i> )	MM
broad interstream divide	BID	mountain slope	MN
butte	BU	mountain valley	MV
canyon bench	CYB	notch	NO
canyon wall	CW	paha	PA
cliff	CJ	peak	PK
colluvial apron	COA	pediment	PE
cuesta	CU	plain ( <i>also Landscape</i> )	PN
dip slope	DL	plateau ( <i>also Landscape</i> )	PT
dome	DO	ridge	RI
escarpment	ES	rim	RJ
faceted spur	FS	rise ( <i>also Micro.; Geom. Comp. – Flats</i> )	RIS
fault block	FAB	rock pediment	ROP
fault-line scarp	FK	scarp	RY
free face ( <i>also Geom. Comp. – Hills, Mountains</i> )	FW	scarp slope	RS
gap	GA	scree slope	SCS
headwall	HW	slickrock ( <i>also Microfeature</i> )	SLK
high hill	HH	spur	SQ
hill ( <i>plural = Landscape</i> )	HI	stack [geom]	SR
hillslope	HS	structural bench	SB
hogback	HO	talus cone	TC
interfluvium ( <i>also Geom. Component - Hills</i> )	IV	talus slope	TAS
knob	KN	tor	TQ
knoll	KL	valley	VA
ledge ( <i>also Microfeature</i> )	LE	valley floor remnant	VFR
		wind gap	WG

*Microfeatures:*

finger ridge	FR	rill	RL
ledge ( <i>also Landform</i> )	LE	rise ( <i>also Microfeature; also Geom. Component – Flat Plains</i> )	RIS
mound	MO	slickrock ( <i>also Landform</i> )	SLK
rib	RB		

**12. EROSIONAL** [Related dominantly to water erosion but excludes perennial, concentrated channel flow (i.e. fluvial, glaciofluvial), or eolian erosion].

*Landscapes:*

badlands	BA	hills	HI
breached anticline (also LF)	BD	mountain range	MR
breaklands	BR	mountains	MO
breaks	BK	piedmont	PI
canyonlands	CL	piedmont slope	PS
dissected breaklands	DB	plateau (also Landform)	PT
dissected plateau	DP	tableland	TB
foothills	FH		

*Landforms:*

ballena	BL	notch	NO
ballon	BV	paha	PA
basin floor remnant	BD	partial ballena	PF
beveled base	BVB	peak	PK
breached anticline (also LS)	BRL	pediment	PE
canyon bench	CYB	plateau (also Landscape)	PT
canyon wall	CW	rock pediment	ROP
col	CL	sabkha	SAB
colluvial apron	COA	saddle	SA
cuesta	CU	scarp slope	RS
cuesta valley	CUV	slickrock (also Microfeature)	SLK
eroded fan remnant	EFR	stack [geom]	SR
eroded fan-remnant side slope	EFS	strike valley	STV
erosion remnant	ER	structural bench	SB
free face (also Geom. Component – Hills, Mountains)	FW	terrace remnant	TER
gap	GA	tor	TQ
hogback	HO	valley border surfaces	VBS
inselberg	IN	valley floor remnant	VFR
ledge (also Microfeature)	LE	wind gap	WG
monadnock	MD	window	WIN

*Microfeatures:*

earth pillar	EP	pinnacle	PI
finger ridge	FR	rib	RB
groove	GR	rill	RL
gully	GU	slickrock (also Landform)	SLK
ledge (also Landform)	LE	swale	SW
hoodoo	HO		

**13. DEPRESSIONAL** (Low areas or declivity features, excluding permanent water bodies).

*Landscapes:*

basin	BS	breaklands	BR
basin floor <i>(also Landform)</i>	BC	dissected breaklands	DB
bolson	BO	semi-bolson	SB
breached anticline <i>(also LF)</i>	BD	valley	VA

*Landforms:*

alluvial flat	AP	open depression <i>(also Micro)</i>	ODE
basin floor <i>(also Landscape)</i>	BC	playa	PL
basin floor remnant	BD	playa floor <i>(also Microfeature)</i>	PFL
box canyon	BOX	playa rim <i>(also Microfeature)</i>	PRI
breached anticline <i>(also LS)</i>	BRL	playa slope <i>(also Microfeature)</i>	PSL
canyon	CA	playa step <i>(also Microfeature)</i>	PST
canyon wall	CW	pothole <i>(also Microfeature)</i>	PH
closed depression <i>(also Micro.)</i>	CLD	pothole lake	WN
col	CL	ravine	RV
coulee	CE	sabkha	SAB
cove	CO	saddle	SA
cuesta valley	CUV	sag <i>(also Microfeature)</i>	SAG
depression	DP	semi-open depression	
drainageway	DQ	<i>(also Microfeature)</i>	SOD
drainhead complex	DRC	slot canyon	SLC
gap	GA	strike valley	STV
gorge	GO	swale <i>(also Microfeature)</i>	SC
gulch	GT	trough	TR
gut [valley]	GV	U-shaped valley	UV
intermontane basin	IB	valley	VA
kettle	KE	valley floor	VL
mountain valley	MV	V-shaped valley	VV

*Microfeatures:*

closed depression <i>(also Landform)</i>	CD	playette	PL
open depression <i>(also Landform)</i>	OP	pothole <i>(also Landform)</i>	PH
playa floor <i>(also Landform)</i>	PF	swale <i>(also Landform)</i>	SW
playa rim <i>(also Landform)</i>	PR	sag <i>(also Landform)</i>	SAG
playa slope <i>(also Landform)</i>	PSL	tree-tip pit	TTP
playa step <i>(also Landform)</i>	PST		

**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*) ES  
 everglades EG

[ Generally, there is no appropriate Wetland Landscape term; by default, choose the most appropriate Landscape term from another Process Environment or Grouping. ]

*Landforms:*

alas	AA	oxbow lake ( <i>water body</i> )	WK
backswamp	BS	peat plateau	PJ
bog	BO	playa ( <i>intermittent water</i> )	PL
Carolina Bay	CB	pocosin	PO
dune slack ( <i>also Microfeature</i> )	DUS	pothole ( <i>also Microfeature</i> )	PH
ephemeral stream ( <i>also Micro</i> )	EPS	pothole lake ( <i>water body</i> )	PH
estuarine tidal stream ( <i>also Micro</i> )	ETS	raised bog	RB
estuary	WD	ribbed fen	RG
fen	FN	sabkha	SAB
flood-plain playa	FY	salt marsh	SM
fringe tidal marsh	FTM	seep ( <i>also Microfeature</i> )	SEE
highmoor bog	HB	semi-open depression	SOD
intermittent stream ( <i>also Micro</i> )	INT	slough ( <i>intermittent water</i> )	SL
lowmoor bog	LX	string bog	SY
mangrove swamp	MAN	swamp	SW
marsh	MA	tidal flat	TF
muskeg	MX	tidal marsh	TM

*Microfeatures:*

dune slack ( <i>also Landform</i> )	DS	playette	PL
ephemeral stream ( <i>also LF</i> )	ES	pothole ( <i>also Landform</i> )	PH
estuarine tidal stream ( <i>also LF</i> )	ETS	seep ( <i>also Landform</i> )	SEE
intermittent stream ( <i>also LF</i> )	INT	vernal pool ( <i>seasonal water</i> )	VP

**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] <i>(also Landform)</i>	BY	<b>ocean</b>	OC
estuary <i>(also Landform)</i>	ES	<b>sea</b> <i>(also Landform)</i>	SEA
gulf <i>(also Landform)</i>	GU	<b>sound</b> <i>(also Landform)</i>	SO
lagoon <i>(also Landform)</i>	LG	<b>strait</b> <i>(also Landform)</i>	ST

*Landforms:*

axial stream	AX	playa lake	WL
bay [coast] <i>(also Landscape)</i>	BAY	pluvial lake	PLL
bayou	WC	pothole lake	WN
cove [ ] <i>(water body)</i>	COW	proglacial lake	WO
dune lake	DUL	river	RIV
estuarine tidal stream <i>(also Micro)</i>	ETS	sag pond <i>(also Microfeature)</i>	SGP
estuary <i>(water body; also LS)</i>	WD	salt pond <i>(also Microfeature)</i>	WQ
fjord	FJ	sea <i>(also Landscape)</i>	SEA
glacial lake	WE	shoal	WR
<b>gulf</b> <i>(also Landscape)</i>	GU	slackwater	WS
gut [ <b>channel</b> ] <i>(also Micro.)</i>	WH	slough	WU
ice-marginal stream	IMS	<b>sound</b> <i>(also Landscape)</i>	SO
inlet	IL	<b>strait</b> <i>(also Landscape)</i>	STT
lagoon <i>(also Landscape)</i>	WI	stream <i>(permanent water)</i>	STR
lagoon channel	LCH	tarn <i>(also Microfeature)</i>	TAR
lake	WJ	thermokarst lake	WV
marine lake	ML	tidal inlet	TI
nearshore zone	NZ	tidal inlet [relict] <i>(water body)</i>	TIR
oxbow lake	WK	tunnel-valley lake	TVL
perennial stream <i>(also Microfeature)</i>	PS		

*Microfeatures:*

channel	CH	pool	POO
estuarine tidal stream <i>(also Landform)</i>	ETS	sag pond	SAG
gut [channel] <i>(w; also Landform)</i>	WH	salt pond	WQ
perennial stream <i>(also Landform)</i>	PS	tank	TN
pond	PO	tarn <i>(also Landform)</i>	TA

**16. SUBAQUEOUS FEATURES** [ Discrete 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 **functionally equivalent** Earth surface features.

*Landscapes:*

bay [coast] ( <i>water body; also LF</i> )	BY	sea ( <i>water body; also Landform</i> )	SEA
estuary ( <i>also Landform</i> )	ES	sound ( <i>water body; also Landform</i> )	SO
gulf ( <i>water body; also Landform</i> )	GU	strait ( <i>water body; also Landform</i> )	ST
lagoon ( <i>water body; also Landform</i> )	LA		
ocean ( <i>water body</i> )	OC		

*Landforms:*

barrier cove	BAC	mainland cove	MAC
bay [coast] ( <i>water body; also Landscape</i> )	BAY	marine lake	ML
bay bottom	BOT	<b>nearshore zone</b>	NZ
cove ( <i>water body</i> )	CO	reef	RF
estuarine tidal stream ( <i>also Micro</i> )	ETS	sea ( <i>water body; also Landscape</i> )	SEA
estuary ( <i>also Landscape</i> )	WD	shoal	WR
flood-tidal delta	FTD	sound ( <i>water body; also Landscape</i> )	SO
flood-tidal delta flat	FTF	strait ( <i>water body; also Landscape</i> )	STT
flood-tidal delta slope	FTS	submerged back-barrier beach	SBB
fluviomarine bottom	FMB	submerged mainland beach	SMB
gulf ( <i>water body; also Landscape</i> )	GU	submerged point bar [coastal]	SPB
inlet	IL	submerged wave-built terrace	SWT
lagoon ( <i>also Landscape</i> )	WI	submerged wave-cut platform	SWP
lagoon bottom	LBO	tidal inlet	TI
lagoon channel	LCH	tidal inlet [relict]	TIR
lake	WJ	washover-fan flat	WFF
lakebed	LB	washover-fan slope	WFS
longshore bar	LON		

*Microfeatures:*

channel ( <i>permanent water</i> )	CH		
estuarine tidal stream ( <i>also Landform</i> )	ETS	gut ( <i>channel; water body</i> )	WH

*Anthropogenic Landforms:*

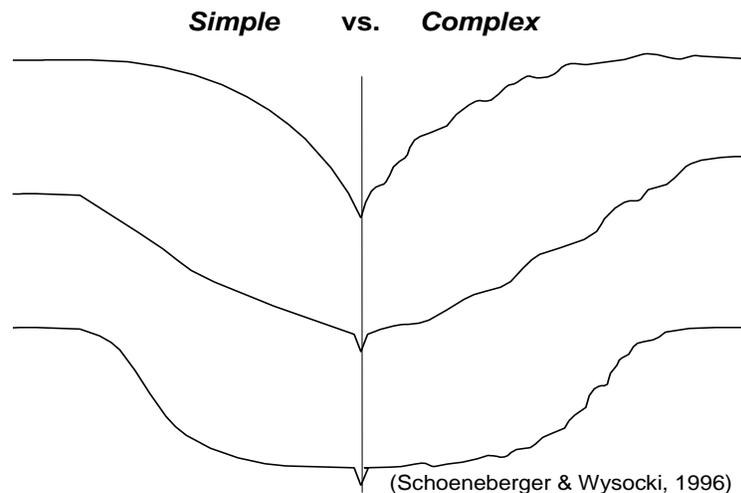
dredge-deposit shoal	DDS	dredged channel	DC
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## PART III : SURFACE MORPHOMETRY

- A) **ELEVATION:** The height of a point on the earth's surface, relative to mean sea level (indicate units); e.g. *106 m* (or *348 ft.*)
- B) **SLOPE ASPECT:** The compass bearing (in degrees, corrected for declination) that a slope faces, looking downslope; e.g. *218°*
- C) **SLOPE 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; e.g., *18%*. NSSH 629

D) **SLOPE COMPLEXITY:**

	<i>Code</i>
	( <u>conventional</u> , <u>NASIS</u> )
simple	S
complex	C

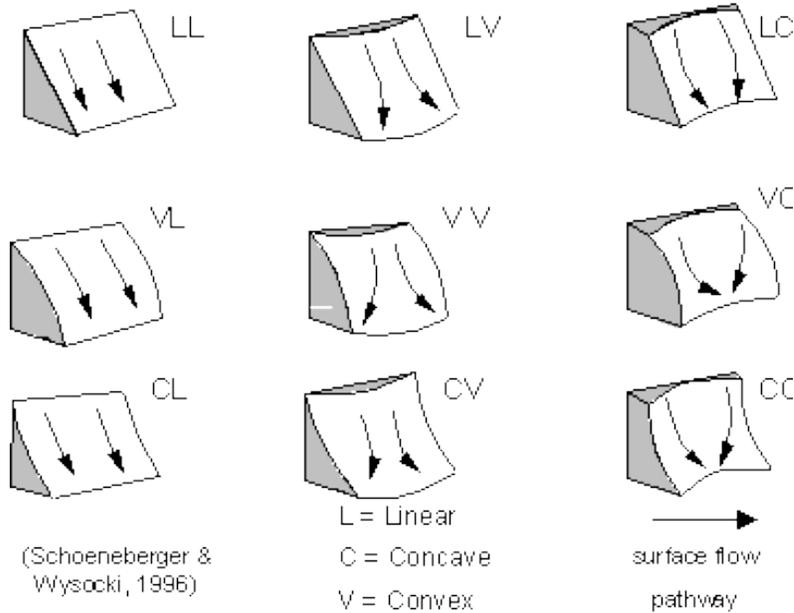


- E) **RELATIVE SLOPE SEGMENT POSITION:** If useful to subdivide long slopes, describe the relative slope location of the area of interest.

Relative Slope Segment Position	Code	Criteria
lower third	LT	on lower third
middle third	MT	on middle third
upper third	UT	on upper third

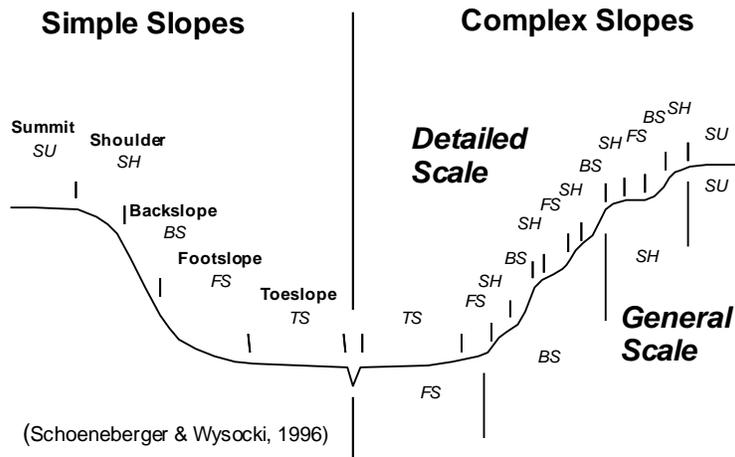
**F) SLOPE SHAPE:** Slope shape is described in two directions: 1) Up & Down slope (perpendicular (normal) to the contour), and 2) Across Slope (along the horizontal contour). e.g. Linear, Convex or LV.

DOWN SLOPE & (Vertical)	ACROSS SLOPE (Horizontal)	<i>Code</i> ( <i>conventional</i> <i>NASIS</i> )	
Concave -	Concave	CC	CC, CC
Concave -	Convex	CV	CC, CV
Concave -	Linear	CL	CC, LL
Convex -	Concave	VC	CV, CC
Convex -	Convex	VV	CV, CV
Convex -	Linear	VL	CV, LL
Linear -	Concave	LC	LL, CC
Linear -	Convex	LV	LL, CV
Linear -	Linear	LL	LL, LL



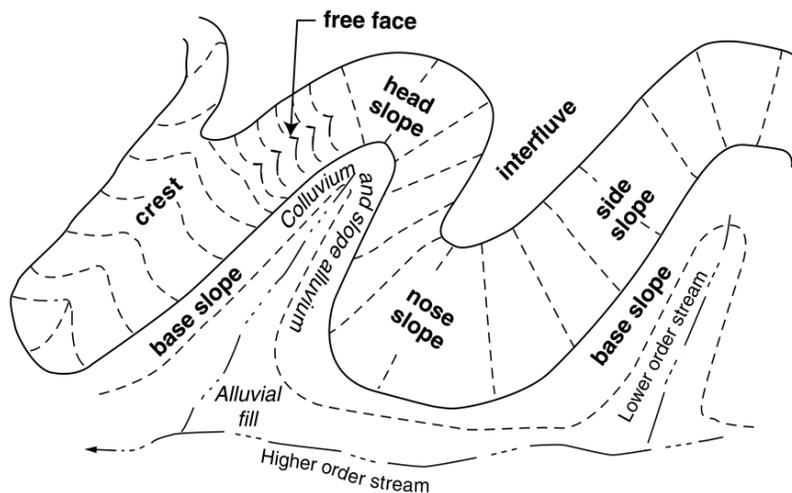
**G) HILLSLOPE - PROFILE POSITION : (2 Dimensional )**

	<u>Code</u>
summit	SU
shoulder	SH
backslope	BS
footslope	FS
toeslope	TS



**H) GEOMORPHIC COMPONENT : ( 3 Dimensional )**

	Code	
1) HILLS :	( <i>conventional</i> )	( <i>NASIS</i> )
interfluve	<i>interfluve</i>	<i>IF</i>
crest	<i>crest</i>	<i>CT</i>
head slope	<i>head slope</i>	<i>HS</i>
nose slope	<i>nose slope</i>	<i>NS</i>
side slope	<i>side slope</i>	<i>SS</i>
free face	<i>free face</i>	<i>FF</i>
base slope	<i>base slope</i>	<i>BS</i>



(adapted from Wysocki, et al., 1999)

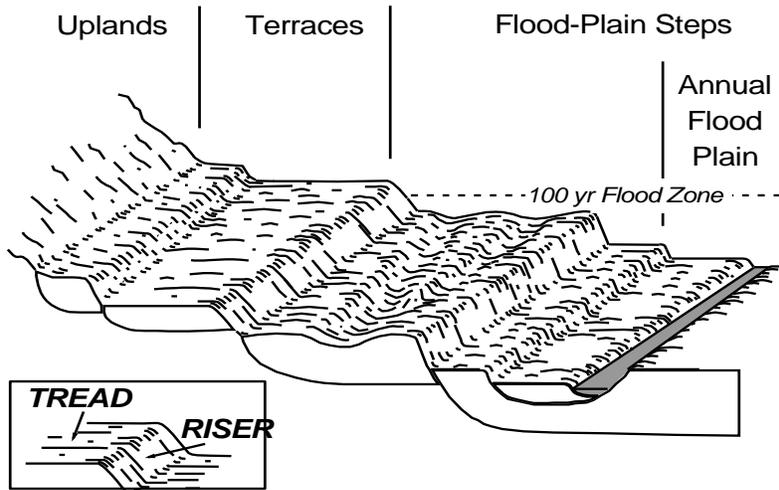
## 2) TERRACES, STEPPED LANDFORMS :

Code  
( conventional / NASIS )

riser  
tread

*riser*  
*tread*

*RI*  
*TR*



## 3) MOUNTAINS : [ under development - comments welcome ]

Code  
( conventional / NASIS )

mountaintop

---

*MT*

mountainflank

---

*MF*

upper third – mountainflank

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*UT*

center third – mountainflank

---

*CT*

lower third – mountainflank

---

*LT*

free face

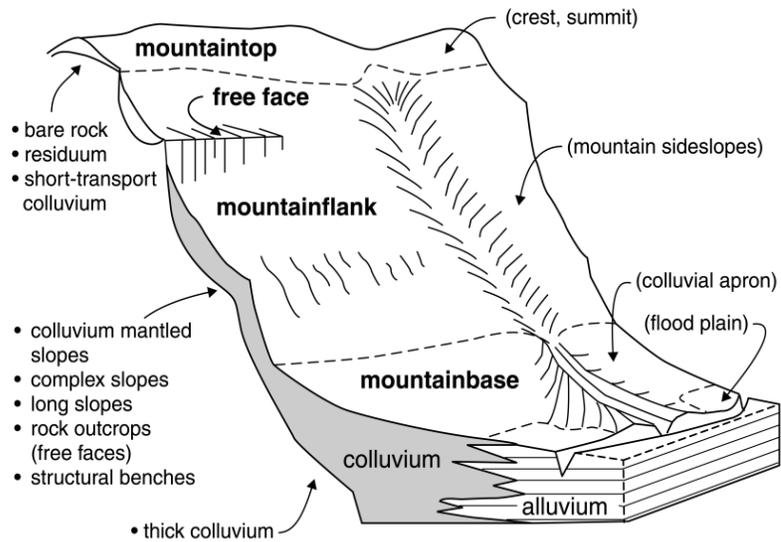
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*FF*

mountainbase

---

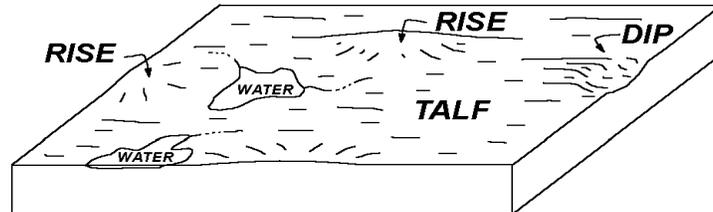
*MB*



(adapted from Wysocki, et.al., 1999)

#### 4) FLAT PLAINS

	Code	
	( <u>conventional</u> )	<u>NASIS</u> )
dip	---	DP
rise	---	RI
talf	---	TF



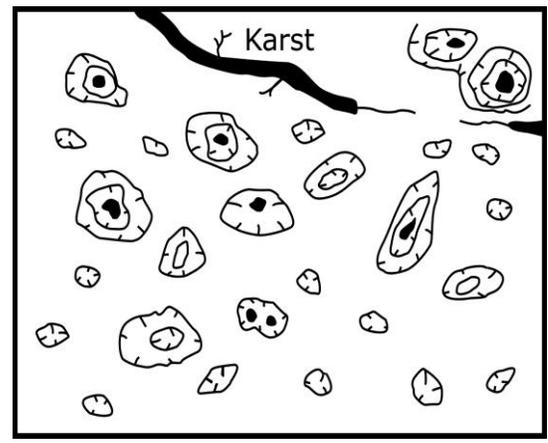
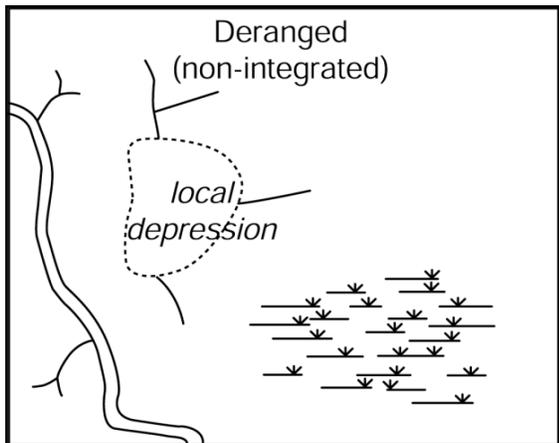
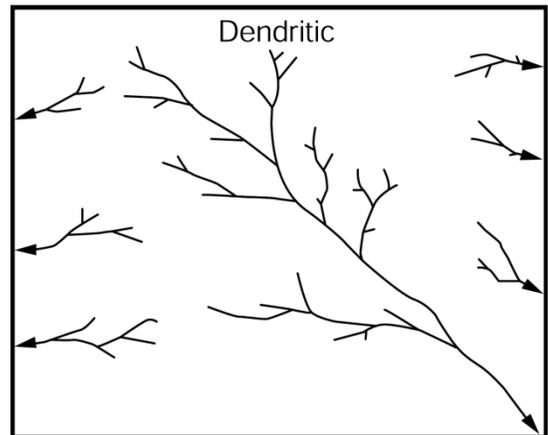
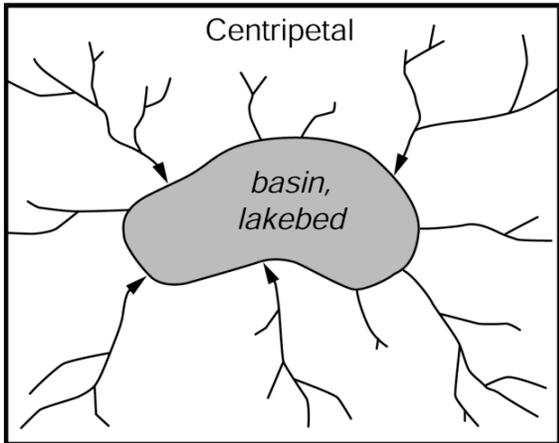
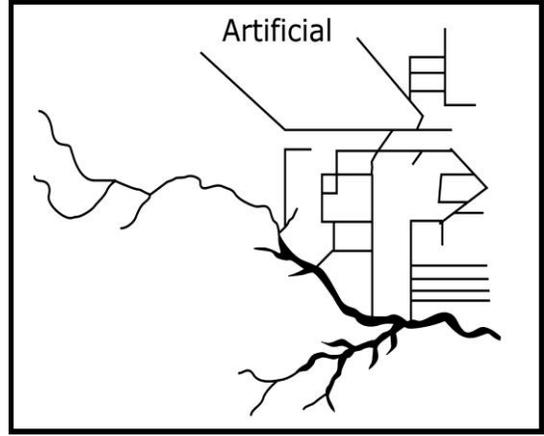
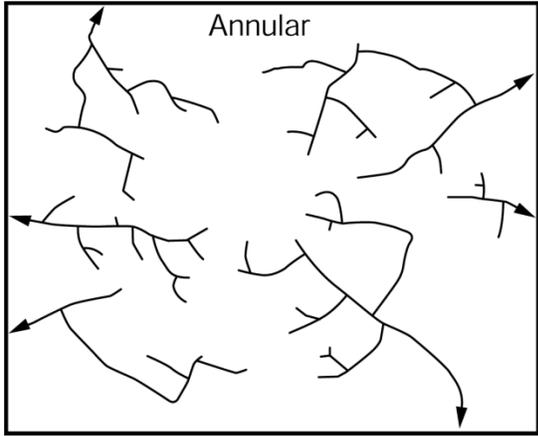
- very low gradients (e.g. slope 0-1%)
- deranged, non-integrated, or incipient drainage network
- "high areas" are broad and low (e.g. slope 1-3%)
- sediments commonly lacustrine, alluvial, or till

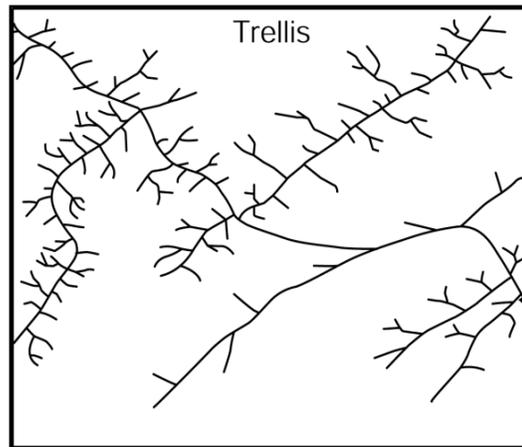
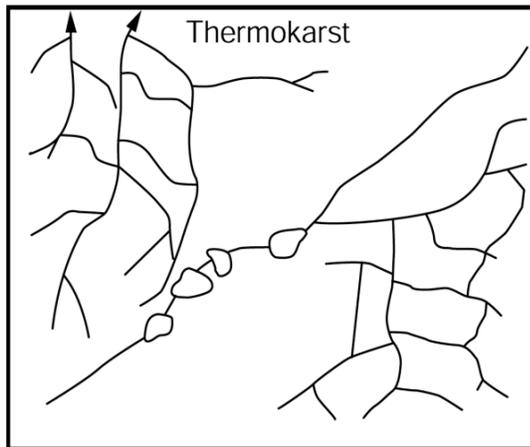
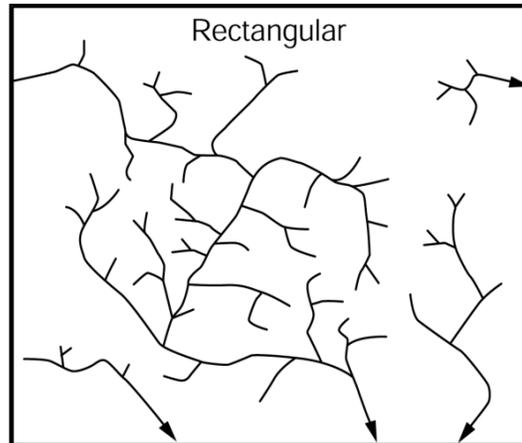
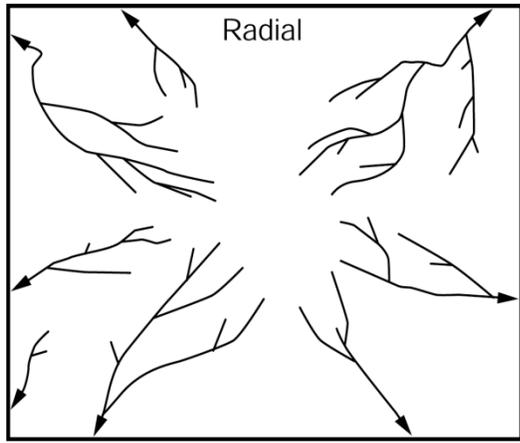
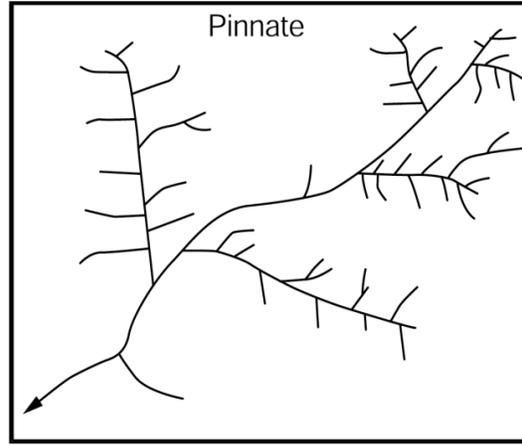
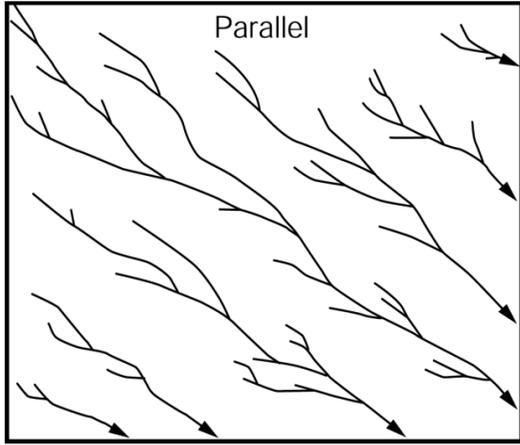
#### I) MICRORELIEF :

	Code	
	( <u>conventional</u> )	<u>NASIS</u> )
microhigh	---	MH
microlow	---	ML
microslope	---	MS

#### J) DRAINAGE PATTERN :

	Code
annular	AN
artificial	AR
centripetal	CE
dendritic	DN
deranged	DR
karst	KA
parallel	PA
pinnate	PI
radial	RA
rectangular	RE
thermokarst	TH
trellis	TR





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## APPENDIX 1: DATA ELEMENT DEFINITIONS

*[The following Data Elements (categories) are arranged by occurrence order in the Geomorphic Description System (GDS), not alphabetically]. Definitions are consistent with the current NASIS Data Dictionary and NSSH, Part 629.]*

### Physiographic Location

A section within the Geomorphic Description System; it provides a hierarchical scheme for partitioning and identifying related portions of the earth's surface based on geography and physiography. SW

### Physiographic Zone

*[ Reserved for global / continental scale groupings; presently not populated . ]*

### 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, Atlantic Plain, Rocky Mountain System, and Interior Highlands in the U.S.A. *[ The highest level in the Physiographic Location part of the Geomorphic Description System ].* 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 region. 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 the 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 NSSH, Part 629

### 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

## 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

## Local Physiographic / Geographic Name

The most localized description of physiographic location; commonly, local feature names found on USGS 7.5 minute topographic quadrangle maps (e.g., Robert's Ridge, Camas Prairie). [ *The fifth highest level in the Physiographic Location part of the Geomorphic Description System* ]. SW NASIS Data Dictionary

## Geomorphic Description

A section within the Geomorphic Description System; it provides a pseudo-hierarchical scheme for identifying natural features on the earth's surface at three relative scales (Landscape, Landform, Microfeature); human created features (Anthropogenic Features) are handled separately. SW NSSH, Part 629

## Landscape

landscape [soils] – A broad or unique land area comprised of an assemblage or collection of natural landforms that define a general geomorphic form or setting (e.g. mountain range, lake plain, lava plateau). Landforms within a landscape are spatially associated but may vary in formation processes and age. SW NSSH, Part 629

## Landform

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 range in size (e.g., *dune* encompasses a number of features including *parabolic dune*, which is several tens-of-meters long, and *seif dune* which can be up to 100 kilometers long. Landforms provide an empirical description of similar portions of the earth's surface features. SW & GG NSSH, Part 629

## 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 NSSH, Part 629

## Anthroscape

(obsolete; replaced by Anthroscape, Anthropogenic Landform, and Anthropogenic Microfeature). An artificial feature on the land 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 (e.g., *quarry*). SW. NSSH, Part 629

## Anthropogenic Landform

a) A discrete, human-made “landform” on the earth’s surface or in shallow water, with a characteristic shape and range in composition (unconsolidated earthy, organic, human-transported materials, or rock) that is the direct result of human manipulation or activities and is mappable at common soil survey scales (e.g., Order 2: > 1: 10,000 and < 1:24,000). Anthropogenic landforms can be either constructional (accumulations; e.g. artificial levee) or destructional (voids; e.g. quarry) in origin. b) A category in NASIS and the Geomorphic Description System for human-derived or modified “landforms”. Compare – anthropogenic microfeature, anthroscape. SW NSSH, Part 629

## Anthropogenic Microfeature

a) A small, human-made “microfeature” on the earth’s surface or in shallow water, with a characteristic shape and range in composition of unconsolidated earthy, organic, human-transported materials, or rock and that is typically too small to delineate at common soil survey scales (e.g., Order 2: > 1: 10,000 and < 1:24,000). Anthropogenic microfeatures can be either constructional accumulations (e.g. railroad bed) or destructional voids (e.g. ditch) in origin. b) A category in NASIS and the Geomorphic Description System for human-derived or modified “landforms”. Compare – anthropogenic landform, anthroscape. SW NSSH, Part 629

## Surface Morphometry

a) The geometry, orientation and relief of related portions of the earth's surface. b) A section within the Geomorphic Description System which provides a scheme for identifying and briefly describing geometry, orientation, position, and relief of portions of the earth's surface. SW NSSH, Part 629

## Elevation [survey]

The height of a point on the earth's surface, relative to mean sea level (msl).  
Compare – relief. SW NSSH, Part 629

## Slope Aspect

The compass direction (in degrees, and accounting for declination) that a slope faces, looking downslope; e.g., 287°. Generalized prose or quadrant descriptions (e.g., “south by southwest”) is not preferred and considered obsolete. SW  
NASIS Data Dictionary

## Slope Gradient

- a) The inclination of the land surface from the horizontal. Percent slope is the vertical distance divided by the horizontal distance, then multiplied by 100; e.g., 18%. SW NSSH, Part 629
- b) The difference in elevation between two points, expressed as a percentage of the distance between those points. SSM, 1993

## Slope Complexity

Used to simplistically describe the relative uniformity (smooth, linear or curvilinear = *simple*) or irregularity (*complex*) of the ground surface leading downslope and through the point of interest. SW  
NASIS Data Dictionary

## Slope Shape [ also called "Land Surface Shape" in SSM (1993) ]

### Slope Shape - Down Slope [ e.g., "...up and down the slope...", SSM, 2017 ]

The geometric, two dimensional profile (shape) of the slope perpendicular to elevation contours.  
NASIS Data Dictionary

### Slope Shape - Across Slope [ e.g., "...shape of the contour...", SSM, 2017 ]

The geometric, two dimensional profile (shape) of the slope parallel to elevation contours.  
NASIS Data Dictionary

## 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 the *summit*, *shoulder*, *backslope*, *footslope*, and *toeslope*. Not all of these segments (positions) are necessarily present along a particular slope. Complex hillslopes include multiple sequences or partial

sequences. Compare – geomorphic components – hills. SW, HP, & RR  
NSSH, Part 629

## 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  
NSSH, Part 629

### Geomorphic Component - Hills

A group of fundamental, three dimensional pieces or areas of hills. In descending elevational order, the geomorphic components of a simple hill are the *interfluvium* (roughly analogous to the summit); *crest* (a hill top or ridge top of converged shoulders); 3 variations of the hillslope, each distinguished by the surface shape and the nature of overland flow: *head slope* (converging surface or overland flow, especially at the head of a drainageway), *side slope* (parallel surface flow), and *nose slope* (diverging surface flow), *free face* (rock outcrop); and the *base slope* (colluvium / slope alluvium apron at the bottom of the hill). SW  
NSSH, Part 629

### 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 or flood-plain step, or other stepped landforms); and the *riser* (the comparatively short escarpment forming the more steeply sloping edge that descends to another level or a channel). SW  
NSSH, Part 629

### 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  
NSSH, Part 629

### 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)], 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 NSSH, Part 629

### 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 scales (e.g. 1:24,000 through 1:10,000). Choices include: *microhigh*, *microlow*. Compare - microfeature. SW NSSH, Part 629

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 NSSH, Part 629

(obsolete) Refers to differences in ground-surface height, measured over [lateral] distances of meters. Naturally formed features contrast with those that are tillage determined. SSM '93, p. 76

### Drainage Pattern

The configuration or arrangement, in plan view, of the stream courses in an area, including gullies or first-order areas of channelized flow, tributaries, and main streams. It is related to the local geologic materials, geomorphologic features and geomorphic history of the area; major drainage pattern types include dendritic, trellis, artificial, etc., also called drainage network. SW, GG, WA

**APPENDIX 2: Glossary of Landform and Geologic Terms; National Soils Handbook (NSSH) - Part 629, National Soil Survey Center, Lincoln, NE**

[ See the current contents of National Soil Survey Handbook, Part 629 “Glossary of Landforms and Geologic Terms” ( Soil Survey Staff, 2017); available at <http://ww.nssc.nrcs.usda.gov> ; look under “Standards for Soil Survey”.]

**Attached, in its entirety, at the back of this document (see the blue section).**

### APPENDIX 3: Excluded terms (formerly used but obsolete or redundant )

#### Excluded Glossary Terms: Landscape

karstland – NP (use *karst*)  
penepplain - NR

#### Excluded Glossary Terms: Landform

active slope - NR  
(reactivated; FY2000)  
alluvial plain - NR (use *flood plain*; ok as a Landscape term)  
alluvial terrace - NP (refer to *stream terrace*)  
alpine - NR  
avalanche track - NR (use *avalanche chute*)  
backshore terrace - NP (refer to *berm*)  
bald – NP (use *summit, mountaintop, etc.*).  
barrier bar - NR (use *longshore bar*)  
beaded drainage pattern - NR (use *beaded stream pattern*)  
bench - NP (refer to *structural bench*)  
bottomland - NR (use *flood plain*)  
braided channel - NR (use *braided stream*)  
boulder field - NR (use *block stream*)  
coalescent fan - NR (use *coalesced alluvial fan, or bajada*)  
coalescent fan piedmont - NP (use *fan piedmont*)  
coppice-mound - NR (use *shrub-coppice dune*)  
crest - NR (ok as Geom. Component - Hills)  
crevasse splay - NR (use *flood-plain splay*)  
dead-ice moraine - NR (use *disintegration moraine*)  
doline - NP (use *sink hole*)  
dry wash - NP (refer to *wash*)  
elevated lake plain - NP (refer to *collapsed lake plain*)  
erosional outlier - NP (refer to *erosional remnant*)  
fan terrace - NP (refer to *fan remnant*)

floodwall - NR (use *levee*)  
fluve - NP (refer to *drainageway*)  
hillside - NR (use *hillslope*)  
hill top - NR (use *summit*)  
interstream divide - NP (refer to *interfluve*)  
meta-stable slope - NR  
mountainside - NR (use *mountain slope*)  
offshore bar - NR (use *barrier beach, longshore bar*)  
remnant - NP (refer to *erosion remnant*)  
rise - NP- (ok as a Micro., Geom. Component - Flat Plains)  
rotational slump - NR (use *rotational landslide*)  
sand ridge - NP (refer to *longshore bar or barrier beach*)  
sand volcano – NP (refer to *sand boil*)  
scroll - NP (refer to *meander scroll*)  
sidewall – NP (use *glacial valley wall*)  
slump – NR (use *landslide or rotational landslide*)  
splay - NP (refer to *flood-plain splay*)  
spur ridge - NR (use *spur*)  
stream channel - NP (refer to *channel*)  
structural back slope -NR (use *dip slope*)  
terrace slope - NR (use *riser*)  
trough end - NR (refer to *cove or cirque*)  
trough valley - NR (refer to *U-shaped valley*)  
trough bottom – NP (refer to *glacial-valley floor*)  
trough wall - NP (refer to *glacial-valley wall*)  
valley wall - NR (see *valley side*)

wave-cut terrace - NR (use *wave-built terrace*)

**Excluded Glossary Terms: Microfeature**

catsteps - NP (refer to *terraces*)  
frost polygons - NR (use *patterned ground*)  
nets (nonsorted) - NP (refer to *patterned ground*)  
nets (sorted) - NP (refer to *patterned ground*)  
nonsorted polygons - NP (refer to *patterned ground*)

sheep tracks - NR (use *terraces*)  
soil ripples - NR (use *terraces*)  
sorted polygon - NP (refer to *patterned ground*)  
stone nets - NP (refer to *patterned ground*)  
swell - NR (ok as a Microfeature)

**Excluded Glossary Terms: Anthropogenic Features (all)**

earth dike [use *levee (streams), artificial levee*]

**Excluded Glossary Terms: Process / Morphology**

mass wasting – NP (use *mass movement*)  
slump (process), slumping – NR (see *rotational landslide, landslide*)

**APPENDIX 4: Maps ( examples of Physiographic Location )**

**General Outline of PART I ) PHYSIOGRAPHIC LOCATION**

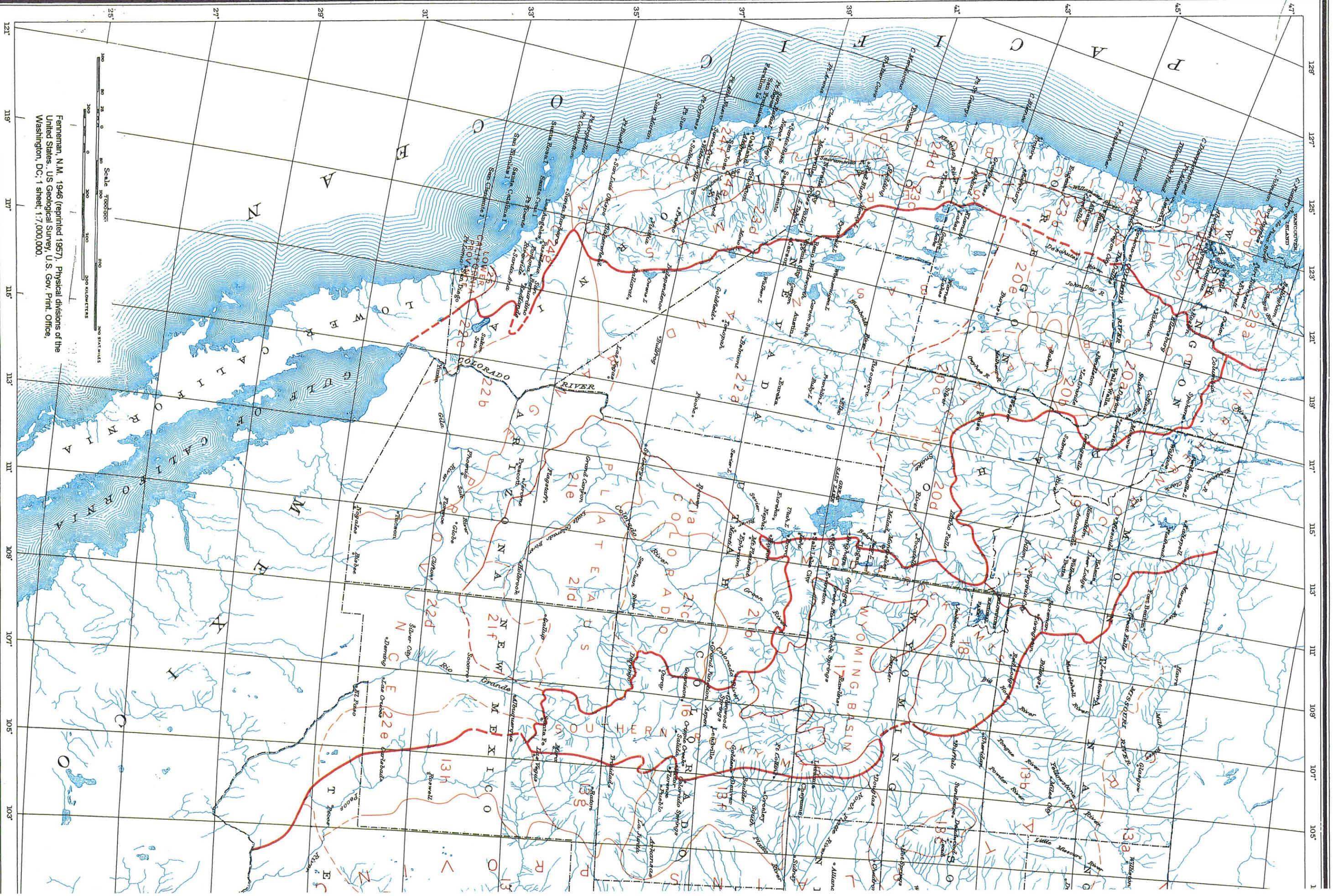
- A) PHYSIOGRAPHIC DIVISION**  
( Choices are expanded from Fenneman 1931, 1938)
  - B) PHYSIOGRAPHIC PROVINCE**  
( Choices are expanded from Fenneman, 1931, 1938)
  - C) PHYSIOGRAPHIC SECTION**  
(Choices are expanded from Fenneman 1931, 1938 )
- } Shown on 1 map  
( broken into third's )

[ Note: The three highest levels are primarily contained in Fenneman's 1946 map (reprinted 1957) and provided (in part or in total) here. Areas outside the conterminous US (Alaska, Pacific, Caribbean) are derived from Wahrhaftig, 1964 or are self evident from the Physiographic Location outline). ]

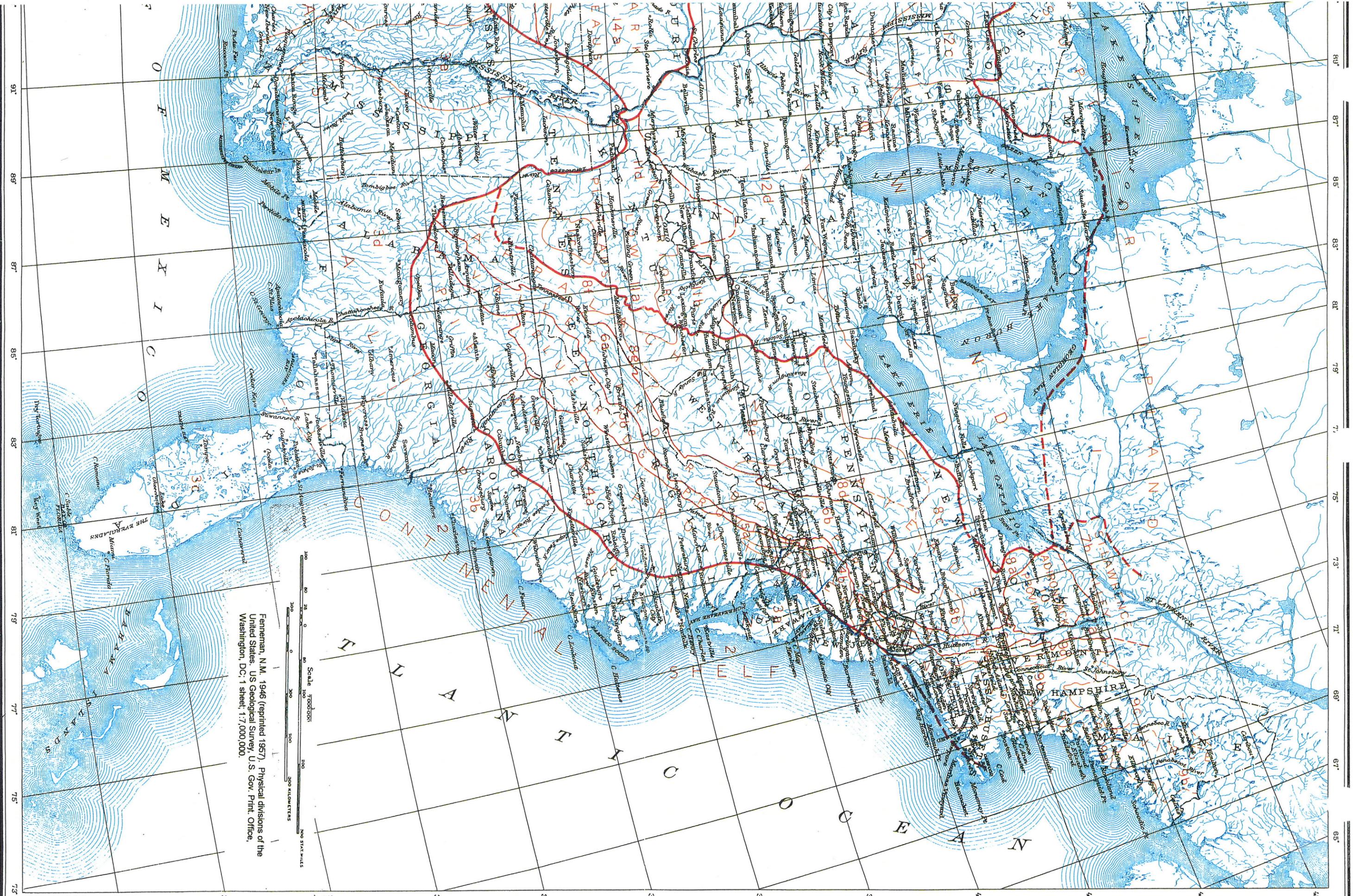
-----  
**D. STATE PHYSIOGRAPHIC AREA (OPTIONAL)**

**E. LOCAL PHYSIOGRAPHIC / GEOGRAPHIC NAME (OPTIONAL)**

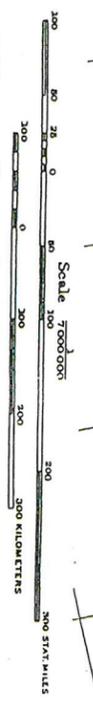
**Map 1: Physiographic Areas of the Coterminous US** [*Fenneman, 1946*  
(reprinted 1957) map] – here split into 3 panels (western, central, and eastern  
US).



Fenneman, N.M. 1946 (reprinted 1957). Physical divisions of the United States. US Geological Survey, U.S. Gov. Print. Office, Washington, DC: 1 sheet, 1:7,000,000.



Fenneman, N.M. 1946 (reprinted 1957). Physical divisions of the United States. US Geological Survey, U.S. Gov. Print. Office, Washington, DC; 1 sheet; 1:7,000,000.





**Map 1a: Inset detail example from Physiographic Areas of the Coterminous US**  
*[ of southwestern United States; Fenneman, 1946 (reprinted 1957) map ]*



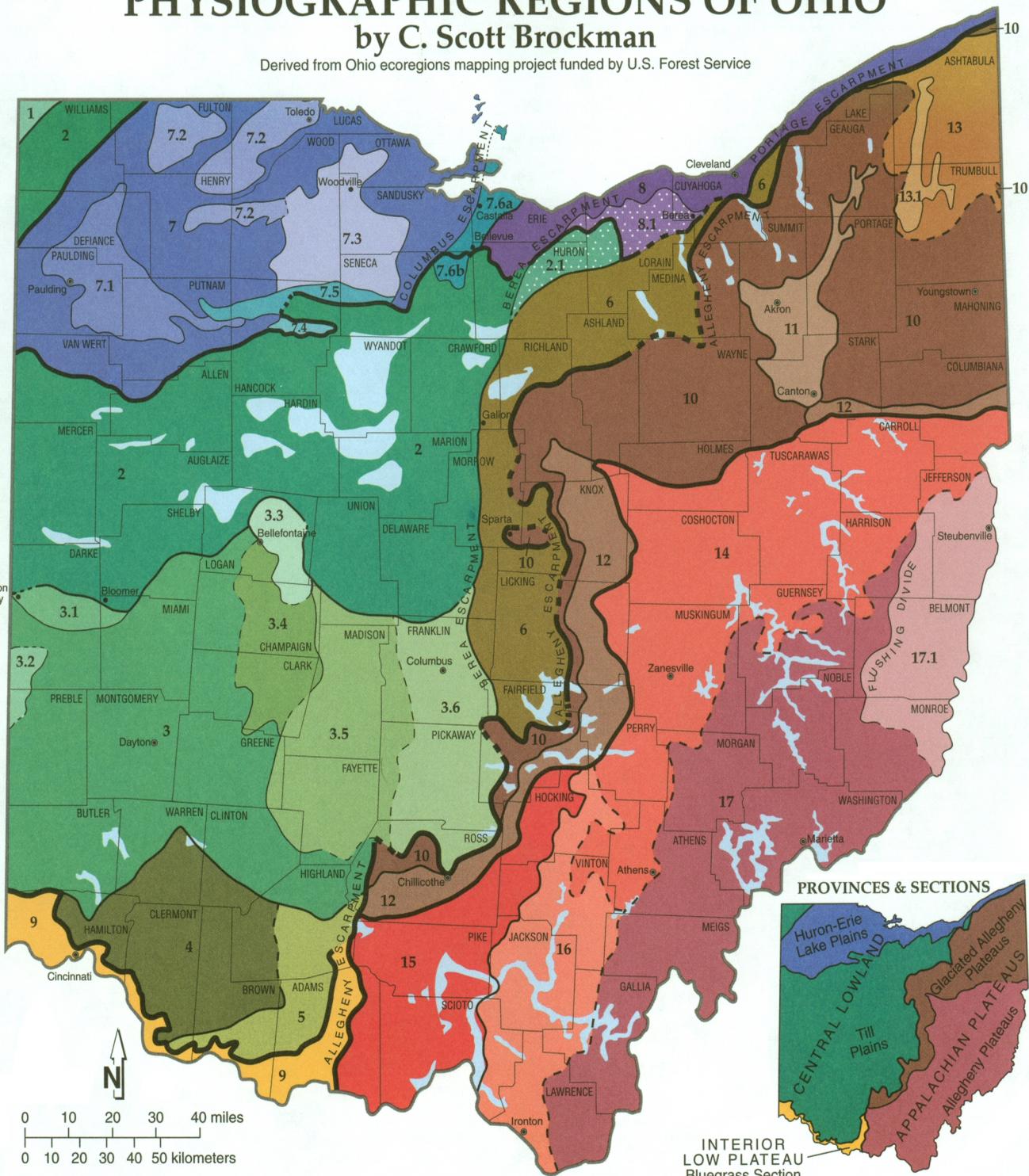
**Map 2: State Physiographic Areas of ... [ choose a State ].**

*[ see attached example 2a: Ohio ]*

# PHYSIOGRAPHIC REGIONS OF OHIO

by C. Scott Brockman

Derived from Ohio ecoregions mapping project funded by U.S. Forest Service



## Till Plains

- 1. Steuben Till Plain
- 2. Central Ohio Clayey Till Plain
  - 2.1. Berea Headlands of the Till Plain
- 3. Southern Ohio Loamy Till Plain
  - 3.1. Union City-Bloomer Transitional Terrain
  - 3.2. Whitewater Interlobate Plain
  - 3.3. Bellefontaine Upland
  - 3.4. Mad River Interlobate Plain
  - 3.5. Darby Plain
  - 3.6. Columbus Lowland
- 4. Illinoian Till Plain
- 5. Dissected Illinoian Till Plain
- 6. Galion Glaciated Low Plateau

- - - Transitional boundary
- ☪ Lake basin/deposits outside Huron-Erie Lake Plains

## Huron-Erie Lake Plains

- 7. Maumee Lake Plains
  - 7.1. Paulding Clay Bottom
  - 7.2. Maumee Sand Plains
  - 7.3. Woodville Lake-Plain Reefs
  - 7.4. Findlay Embayment
  - 7.5. Fostoria Lake-Plain Shoals
  - 7.6a and 7.6b. Bellevue-Castalia Karst Plain
- 8. Erie Lake Plain
  - 8.1. Berea Headlands of the Erie Lake Plain

## Bluegrass Section

- 9. Outer Bluegrass Region

## Glaciated Allegheny Plateaus

- 10. Killbuck-Glaciated Pittsburgh Plateau
- 11. Akron-Canton Interlobate Plateau
- 12. Illinoian Glaciated Allegheny Plateau
- 13. Grand River Low Plateau
  - 13.1 Grand River Finger-Lake Plain

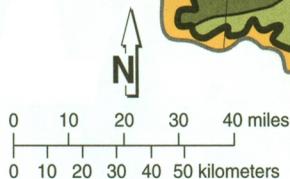
## Allegheny Plateaus

- 14. Muskingum-Pittsburgh Plateau
- 15. Shawnee-Mississippian Plateau
- 16. Ironton Plateau
- 17. Marietta Plateau
  - 17.1. Little Switzerland Plateau

## PROVINCES & SECTIONS



INTERIOR  
LOW PLATEAU  
Bluegrass Section



**Map 2: State Physiographic Areas of ... [ choose a State ].**

*[ see attached example 2b: New Mexico (Hawley, J.S., 2005) ]*



TABLE 1. Key to symbols for and physiographic setting of *Ice-Age* landscape features shown on Figure 1.

Symbol	Basins and Physiographic Features		Physiographic province & section
	<b>Basins with</b>	<b>Pluvial Lakes</b>	
<b>SAb</b>	San Agustín Plains	<i>San Agustín</i>	Transition Zone/Datil-Mogollon
<b>Ab</b>	Animas	<i>Animas</i>	Mexican Highland
<b>Cb</b>	Cloverdale (San Luis)	<i>Cloverdale</i>	
	Bolson del los Muertos	<i>Palomas</i>	Mexican Highland/Rio Grande rift
<b>Pr</b>	<b>Ig</b> Southern Palomas	<i>Goodsight</i>	
<b>HMb</b>	Hachita-Moscós	<i>Hachita</i>	Mexican Highland
<b>JMb</b>	<b>It</b> Jornada del Muerto	<i>Trinity</i>	Mexican Highland/Rio Grande rift
<b>Mb</b>	Lower Mimbres River	<i>Palomas</i>	
<b>Pb</b>	Playas	<i>Playas</i>	Mexican Highland
<b>Tb</b>	Tularosa	<i>Otero</i>	Mexican Highland/Rio Grande rift
<b>Esb</b>	Estancia	<i>Estancia</i>	Sacramento
<b>Enb</b>	Encino	<i>Encino</i>	Sacramento
	<b>ls</b> Lower Sacramento Rv	<i>Sacramento</i>	Sacramento
<b>Sb</b>	Salt	<i>King</i>	Sacramento
<b>PV</b>	<b>al</b> Portales Valley-Blackwater Draw	<i>Arch</i>	Great Plains/ Southern High Plains
	<b>Rio Grande Corridor Basins/Narrows</b>		
<b>SLr</b>	San Luis		Southern Rocky Mountains/Rio Grande rift
<b>Er</b>	Española		Mexican Highland/Rio Grande rift
<b>Ar</b>	Albuquerque (Santo Domingo & Belen sub-basins)		Mexican Highland/Rio Grande rift
<b>Sr</b>	Socorro (Valley)		Mexican Highland/Rio Grande rift
<b>MGr</b>	“Milligan Gulch basin”		Mexican Highland/Rio Grande rift
<b>TCr</b>	Truth or Consequences “narrows”		Mexican Highland/Rio Grande rift
<b>Pr</b>	Palomas		Mexican Highland/Rio Grande rift
<b>Rr</b>	Rincon (Valley)		Mexican Highland/Rio Grande rift
<b>Mr</b>	Mesilla		Mexican Highland/Rio Grande rift
<b>EPr</b>	El Paso del Norte “narrows”		Mexican Highland/Rio Grande rift
<b>Hr</b>	Hueco Bolson		Mexican Highland/Rio Grande rift
	<b>Mountains and Ranges</b>		
<b>BR</b>	Black Range		Transition Zone/Datil-Mogollon
<b>CM</b>	Capitan Mountains		Sacramento
<b>JM</b>	Jemez Mountains & Valles caldera		Southern Rocky Mountains
<b>MT</b>	Mount Taylor		Colorado Plateau/Acoma-Zuni
<b>OM</b>	Organ Mountains		Mexican Highland
<b>SAR</b>	San Andres Range		Mexican Highland
<b>SB</b>	Sierra Blanca		Sacramento
<b>SM</b>	Sacramento Mountains		Sacramento
<b>ZM</b>	Zuni Mountains		Colorado Plateau

egories and subcategories include:

**Table 2A.** Cross-reference subcategory key to **General Background** citations: **A1.**

**Introspective, and Present to Future; A2a-b. History, Culture, and Physiographic Setting; A3a-d. State Agencies and USGS; A4a-c. NMGS; A5. Guidebooks-Late Neogene; A6. Biographies and Memorials; A7a-c. 1806-1895: Exploration, Conquest, and Early Surveys; A8a-b. 1895-1946: Dawn of Modern Geology and World War Era; and A9. Kirk Bryan Legacy.**

**Table 2B.** Cross-reference subcategory key to **Evolution of Concepts and Technologies** citations: **B1. Twentieth Century Milestones; B2. Geochronology and Biostratigraphy; B3. Tephrochronology and Fission-Track Dating; B4. Plate Tectonics and Geomagnetism; B5. Paleoclimatology, paleoecology, and glacial-pluvial systems; B6. Evolution of Fluvial Systems and Alluvial Chronologies; B7. Neotectonics and Fluvial-System Evolution; B8. Review Volumes and Textbooks.**

**Table 2C.** Cross-reference subcategory key (C1-5) to **Special Topics** citations: **C1a-f. Soils and Geomorphology; C2a-c. Lakes and Glaciers; C3. Hydrogeology of Intermontane Basins; C4a-c. Caves and Karst; C5a-d. Photography and Imagery**

**Table 2D.** Cross-reference key to citations organized by **Physiographic and/or**

**Tectonic provinces: D1** (New Mexico regional); **D-SRM** (Southern Rocky Mountains); **D-RGr** (Rio Grande rift); **D-CP** (Colorado Plateau); **D-TZ** (Transition Zone); **D-B&R** (southeastern Basin and Range); **D-SGP** (Southern Great Plains)

**Table 2** sections and the overview (**Part 1** and **2**) discussions that follow the **Retrospective** introduce the myriad publications on this region’s rich natural history, as well as document many information gaps and research opportunities. For example, one major area of published research that is not addressed here deals with the vast fossil record preserved in *caves* of all types and sizes (**Table 2: C4**). A productive search for information on this topic should start with the companion paper by Art Harris and related publications (e.g. Harris and Finley, 1964; Simons and Alexander, 1964; Van Devender and Worthington, 1977; Betancourt et al., 1991; Harris, 1997, 2003; **Table 2: B2, 5, 8; C4a, c**). Examples of *Ice-Age* research opportunities include detailed field and laboratory investigations on 1) New Mexico’s ancient glaciers, paleolakes, and associated fluvial systems, particu-

**Map 3: Local Physiographic / Geographic Areas**

*[ see attached example: Southeastern Oregon (Raisz, 1941) ]*



**Part 629 - GLOSSARY OF LANDFORM AND GEOLOGIC TERMS****VERSION 9.0, AUGUST 2017****CONTENTS**

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*( Contains updates to this section per NSSH (August, 2017) )*

## 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 definitions to:

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

### 629.01 Responsibilities.

This glossary is the National Cooperative Soil Survey (NCSS) standard 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, 2005) serves as a major source for many glossary terms. The American Geologic Institute (AGI) granted USDA-NRCS (formerly SCS) permission (letters dated 9/11/85 and 9/22/93) to use existing definitions. Modifications to original AGI definitions are explained below.

### 629.02 Definitions.

**(a) Reference Codes.** Sources for definitions whole or in part, contained herein are denoted by code (e.g. GG) following each definition. Underscored codes (e.g. GG) signify 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, 4<sup>th</sup> 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 GPO, 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 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
- GG'97 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, 3<sup>rd</sup> 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. 519p.
- GSST Soil Science Society of America. 2011. Glossary of Soil Science terms. Soil Science Society of America, Madison, WI.
- 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, 2<sup>nd</sup> 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.
- HS Sigurdsson, H., (ed). 2000. Encyclopedia of volcanoes. Academic Press, Inc., San Diego, USA. ISBN# 0-12-643140-X
- ICOMANTH International Committee on Anthropogenic Soils (2012 - personal communication; J. Galbraith)
- 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. 1999. Soil Taxonomy, 2<sup>nd</sup> 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.
- SW Schoeneberger, P.J. and Wysocki, D.A. 2013. (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 alternative terms.
- ... **(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. Ccolloquial terms in general are not widely accepted known beyond the geographic area of origin. 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.**

**aa 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

**aa lava flow** - A type of basaltic lava flow dominated by aa 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** - (not preferred – refer to supraglacial till, supraglacial flow till, supraglacial melt-out till).

**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; obsolete) A mountain or hill slope that is responding to valley incision with erosion (either geologic or accelerated) exceeding regolith weathering, and that has detritus accumulated behind obstructions indicating contemporary transport of slope alluvium. Slope gradients usually exceed 45 %. Compare - metastable slope. SW

**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

**agricultural anthroscape – A human-modified “landscape” dominated by permanent, extensive alterations to the physical shape and/or internal stratigraphy of the land due to agricultural management for food, fiber or forage production, that have substantively altered water flow and sediment transport across and within the regolith (e.g., leveled land). Commonly excludes areas of minor alterations (e.g. shallow plowing) that are easily obscured or obliterated by natural bio-, pedo-, or cryoturbation. Compare – hillslope terrace anthroscape, urban anthroscape, suburban anthroscape. SW**

**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. Compare – fan remnant, eroded fan remnant, eroded fan remnant sideslope. 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 (channel flow), 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

**andesitic lahar deposit** – A lahar dominated by andesitic volcanoclastics. 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** a) **An enduring, human-made (or extensively modified), surface or subsurface feature (e.g. fire pit), mark (e.g., shovel mark), structure (e.g. building pad) or other physical evidence of human manipulation (after Hester et al., 1975). Note: Phenomena that do not leave permanent evidence of human-**

**activity (e.g., features of accelerated erosion, amendments of inorganic fertilizers or lime, shallow plowing or in-situ mixing) are not included. Artifacts (specific objects, pieces) are not included (use – human artifacts).** SW, & ICOMANTH b) (obsolete – use Anthroscape, Anthropogenic Landform, or Anthropogenic Microfeature) **A**n 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). c) Formerly a category in NASIS and the Geomorphic Description System, subsequently subdivided into and replaced by anthroscares, anthropogenic landforms, and anthropogenic microfeatures. SW, ICOMANTH

**anthroscape** – a) A human-modified “landscape” of substantial and permanent alterations (removal, additions, or reorganization) of the physical shape and /or internal stratigraphy of the land, associated with management for habitation, commerce, food or fiber production, recreation, or other human activities that have substantively altered water flow and sediment transport across or within the regolith. SW; b) A category in NASIS and the Geomorphic Description System for large, human-modified areas. Compare – anthropogenic landform, anthropogenic microfeature. SW

**anthropogenic landform** – a) **A discrete, human-made “landform” on the earth’s surface or in shallow water, with a characteristic shape and range in composition (unconsolidated earthy, organic, human-transported materials, or rock) that is the direct result of human manipulation or activities and is mappable at common soil survey scales (e.g., Order 2: > 1: 10,000 and < 1:24,000). Anthropogenic landforms can be either constructional (accumulations; e.g. artificial levee) or destructional (voids; e.g. quarry) in origin. b) A category in NASIS and the Geomorphic Description System for human-derived or modified “landforms”. Compare – anthropogenic microfeature, anthroscape. SW**

**anthropogenic microfeature** - a) A small, human-made “microfeature” on the earth’s surface or in shallow water, with a characteristic shape and range in composition of unconsolidated earthy, organic, human-transported materials, or rock and that is typically too small to delineate at common soil

**survey scales (e.g., Order 2: > 1: 10,000 and < 1:24,000). Anthropogenic microfeatures can be either constructional accumulations (e.g. railroad bed) or destructional voids (e.g. ditch) in origin. b) A category in NASIS and the Geomorphic Description System for human-derived or modified "landforms". Compare – anthropogenic landform, anthroscape. 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

**artifact** - An artificial (human-derived) object or material (e.g. brick, concrete, metal, plastic, lumber, etc.), commonly larger than 2mm in diameter, made and deposited in association with habitation,

manufacturing, excavation, or construction activities. SW

**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 field** – A land area covered by a relatively thick or distinctive, surficial deposit of volcanic ash (air fall) that can be traced to a specific source and has well defined boundaries. An ash field can be distinguished from adjacent landforms or land areas based on ash thickness, mineral composition, and physical characteristics. Soils within an ash field form solely or predominantly within the ash deposit. SW & GG

**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 network with high drainage densities and short, steep slopes with narrow interfluves. Badlands develop on surfaces with little or no vegetative cover, overlying unconsolidated or poorly cemented materials (clays, silts, or in some cases sandstones) sometimes with soluble minerals such as gypsum or halite. GG

**bajada** - (colloquial: southwestern U.S.A.) A broad, gently inclined, alluvial piedmont slope extending from the base of a mountain range out into a basin and formed by the lateral coalescence of a series of alluvial fans. Typically it has a broadly undulating transverse profile, parallel to the mountain front, resulting from the convexities of component fans. The term is generally restricted to constructional slopes of intermontane basins. Synonym - coalescent fan piedmont. Compare - fan apron. HP & SW

**bold** - (not preferred; colloquial: southeastern USA; use summit, mountaintop, etc.) An ecological term for the grass or shrub covered (naturally tree-less) summit of a high elevation hill or mountain, flanked

by forested slopes; not above the local tree-line. Compare – glade. SW & GG

**ballena** - (colloquial: western U.S.A.) A fan remnant having a distinctively-rounded surface of fan alluvium. The ballena's broadly-rounded shoulders meet from either side to form a narrow summit and merge smoothly with concave side slopes and then concave, short pediments which form smoothly-rounded drainageways between adjacent ballenas. A partial ballena is a fan remnant large enough to retain some relict fan surface on a remnant summit. Compare - fan remnant. SW & FFP.

**ballon** - (colloquial: western U.S.A.) A rounded, dome-shaped hill, formed either by erosion or uplift. GG

**bar** - [streams] A general term for a ridge-like accumulation of sand, gravel, or other alluvial material formed in the channel, along the banks, or at the mouth of a stream where a decrease in velocity induces deposition; e.g. a channel bar or a meander bar. [coast] - A generic term for any of various elongate offshore ridges, banks, or mounds of sand, gravel, or other unconsolidated material submerged at least at high tide, and built up by the action of waves or currents, especially at the mouth of a river or estuary, or at a slight distance offshore from the beach. Compare - longshore bar. GG & GSST

**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 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

**barrier beach [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 - refer to subglacial till).

**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 pediment 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 km<sup>2</sup>) and no known bottom (e.g. Idaho batholith). Compare - stock. SW & GG

**bauxite** - An off-white to dark red brown weathered detritus or rock composed of aluminum oxides (mainly gibbsite with some boehmite and diaspore), iron hydroxides, silica, silt, and especially clay minerals. Bauxite originates in tropical and subtropical environments as highly weathered residue from carbonate or silicate rocks and can occur in concretionary, earthy, pisolitic or oolitic forms. 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. (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 carapaced 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

**bioswale** - An artificially constructed or modified closed basin or semi-open basin or drainageway designed to capture storm water runoff primarily from impervious surfaces (e.g. parking lots, roofs) and to maximize onsite infiltration in order to reduce runoff, to improve water quality by soil filtration, and to recharge local ground water. SW

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

**block [volcanic]** – (not preferred) refer to *volcanic block*.

**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 aa lava but the fragments are larger and more regular in shape, somewhat smoother, and less vesicular. Compare – aa lava, pahoehoe lava, pillow lava. GG

**block lava flow** – A lava flow dominated by block lava. Compare – aa 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 aa 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 inward 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 sheets, dunes, and playa landforms. The piedmont slope above a bolson includes erosional surfaces (pediments) and older depositional surfaces (fans) that adjoin the mountain front. A semi-bolson is an externally drained (open) bolson. Synonym - intermontane basin. SW, GG and FFP.

**bomb [volcanic]**- (not preferred) refer to *volcanic bomb*.

**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 morphology centered under and surrounding the microlows of 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 clays (e.g. Vertisols). Bowl morphology is distinct from that in adjacent microslopes (intermediate position) and microhighs (chimney). 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

**breached anticline** – A structurally-controlled landscape or landform typically underlain by sedimentary rocks in which an anticline crest has been eroded such that the former crest has become a canyon or valley flanked by inward-facing erosional scarp slopes or cliffs and outward-facing dip slopes. Associated landforms include cuestas and strike valleys. SW & GG

**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

**breaklands** – An assemblage of very steep (e.g. 60-90 %), high relief slopes flanking major rivers and streams in mountainous terrain that form the walls of a v-shaped river valley. Breaklands are characterized by colluviated slopes of which the majority of the ground surface drains directly to a large axial stream at the base, and the remainder consists of shallowly incised, parallel drainageways. Breaklands have shallow to very deep soils, substantial rock outcrop, and have more frequent fires than lower gradient mountain slopes above; extensive along the rivers and streams of the Idaho Batholith. Compare – dissected breaklands. SW & HD

**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 pile, hillock or human-made hill, composed of debris or earth heaped up to mark a burial site. ICOMANTH & 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** - A relatively narrow, flat surface along a canyon wall caused by differential erosion of alternating resistant and less-resistant horizontal strata; a type of structural bench. Compare - canyon wall. SW & 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 interfluvies than found in badlands. Side slopes exhibit extensive erosion, active back-wearing, and relatively sparse vegetation. SW

**canyon wall** - The steep to near vertical slope between a canyon bottom and higher, adjacent hillslopes, mountain slopes, or summits. Canyon walls are generally dominated by rock outcrop and/or bedrock within the soil profile. Canyon walls commonly include cliffs or ledges, and may include a *beveled base* cut into less resistant rocks (e.g. shale). In large canyons (e.g. Grand Canyon),

canyon walls may be vertically interrupted by nearly level or gentle slopes of *canyon benches*. 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 morphology that forms a crude cone or wave-crest structure centered under a microhigh (e.g. a low mound or rim) and extending at least part-way under adjacent microslopes; 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 microhigh. Its morphology is distinct from the soil solum of adjacent microslopes and microlows (e.g. lighter colored, more alkaline and contain carbonate or gypsum concretions absent under microslopes and microlows). 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], volcanic block, lapilli, scoria, tephra. KST

**circles** - 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

**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

**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

**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

**composite cone** – (not preferred) see stratovolcano.

**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 dune field** – An extensive area of small, streamlined shrub-coppice dunes that form around brush and other clump vegetation; a type of dune field. Shrub-coppice dunes are commonly 50 – 300 cm high and 1-7m wide. SW

**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

**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

**coral limestone** – An informal term for massive limestone composed primarily of coral and coral fragments commonly associated with marine islands or coral reefs in tropical or subtropical waters. Compare – coral island. SW

**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** – 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

**cove** [water] – a) 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

**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]** – see *volcanic crater*.

**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 or mantle that results from very slow downslope mass wasting of unconsolidated earthy material down slopes, driven primarily by gravity, but facilitated by water saturation and by 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 microbiotic 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 - microbiotic crust. SW & SS

**cuesta** - An asymmetric ridge capped by resistant rock layers of slight to moderate dip, commonly less than 10° (approximately < 15 percent slopes); 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 through the tilted rocks. Compare – hogback, homoclinal ridge, mesa, dip slope, scarp slope, cuesta valley. SW & HP

**cuesta valley** - An asymmetrical depression adjacent to a cuesta that lies parallel to the strike of the underlying strata; a type of strike valley. It's formed by the 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**– 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 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, road cut. SW

**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". Cyclothem 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 cyclothem. 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** – [geology] A lacustrine or marine 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 (*diatomite*). GSST

**diatomaceous earth** – [**Soil Taxonomy**] A layer of soil material (limnic materials) that is composed of diatoms. Diatomaceous earth is identified by several diagnostic criteria such as moist color value which changes on drying as a result of the irreversible shrinkage of organic-matter coats on diatoms and either a moist color value of 8 or more and a chroma of 2 or less from a saturated sodium-pyrophosphate extract on white chromatographic or filter paper, or a cation-exchange capacity of less than 240 cmol<sup>(+)</sup> per kg organic matter (measured by loss on ignition). KST

**diatomite** – A light-colored, soft, siliceous sedimentary rock consisting chiefly of opaline diatom frustules deposited in a lacustrine or marine environment. Diatomite has a number of uses owing to its high surface area, absorptive capacity, and relative chemical stability but the term is generally reserved for deposits of actual or potential commercial value. Compare – diatomaceous earth. GG

**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 tal, 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 with 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

**dissected breaklands** – Very steep slopes flanking major rivers and streams in mountainous terrain and dominated by deeply incised, sub-parallel to dendritic, chute-like drainageways that occupy > 50 % of the ground surface. Dissected breakland slopes are dominated by hillslope elements that grade to secondary drainageways, rather than directly to the axial stream; a type of breakland. SW & HD

**dissected plateau** – A land area (landscape) produced by significant stream erosion and incision of a plateau such that only a small part of the plateau surface is at or near the original summit level. Much of the area occurs as hillslopes, or if incision is

sufficient and relief is > 1000 feet, as mountain slopes. Compare – plateau. 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 two adjacent drainage basins; a divide separates the 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 the 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. Compare – coppice dune field. 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

**dune traces** – A series of linear to semi-concentric micro-ridges and intervening troughs, on the floor of a dune slack or interdune that were exposed by deflation or dune migration. The ridges are remnant bases of slip face lamina held together by soil moisture and/or cemented by evaporites. SW

**earth dike** - (not preferred) refer to levee (stream).

**earth fall** – see soil fall.

**earthflow** [mass movement] – The process, associated sediments (earthflow deposit) or resultant landforms characterized by slow to rapid flow dominated by downslope movement of soil, rock, and mud (more than 50% of the particles are < 2 mm), and whether saturated or comparatively dry, behaves as a viscous fluid when moving. Compare – debris flow (coarser, less fluid), mudflow (finer, more fluid). SW

**earth hummock** - A type of hummock consisting predominantly of a core of silty and clayey mineral soil and showing evidence of cryoturbation. Earth hummocks are a type of nonsorted circle commonly found in tundra or permafrost (typically 10-50 cm height; 20-300 cm diameter). Compare - turf hummock, hummock [patterned ground], non-sorted circle, patterned ground. NRC

**earth pillar** - A tall, conical column of unconsolidated to semi-consolidated earth materials (e.g. clay till, or landslide debris) produced by differential erosion and usually capped by a flat, hard rock fragment that shields the underlying, softer material from erosion. It can measure up to 6-20 m in height, and its diameter is a function of the width of the protective boulder. Compare - hoodoo. GG

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

**earth topple** [mass movement] – The process, associated sediments (earth topple deposit) or resultant landform characterized by a localized, very

rapid type of *topple* in which large blocks of soil material literally fall over, rotating outward over a low pivot point; sediments < 2 mm predominate. Portions of the original material may remain intact, although reoriented, within the resulting deposit. Compare –debris topple, rock topple, landslide. SW

**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 epoch 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, **eolian** 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

**ephemeral stream** – Generally a small stream, or upper reach of a stream, that flows only in direct

response to precipitation. It receives no protracted water supply from melting snow or other sources and its channel is above the water table at all times. Compare – arroyo, intermittent stream, perennial stream. HP

**ephemeral lake – (not preferred) Compare - pluvial lake, pluvial lake [relict], playa lake, glacial lake, proglacial lake.**

**epiclastic** - Pertaining to any clastic rock or sediment other than pyroclastic. Constituent fragments are derived by weathering and erosion rather than by direct volcanic processes. Compare - pyroclastic, volcanoclastic, clastic, detritus. HP

**eroded fan remnant** – All, or a portion of an alluvial fan that is much more extensively eroded and dissected than a fan remnant; sometimes called an *erosional fan remnant* (FFP). It consists primarily of a) eroded and highly dissected sides (*eroded fan-remnant sideslopes*) dominated by hillslope positions (shoulder, backslope, etc.), and b) to a lesser extent an intact, relatively planar, relict alluvial fan “summit” area best described as a tread; **e.g. < 50 % of the original fan surface remains.** SW & FFP

**eroded fan-remnant sideslope** – A rough or broken margin of an *eroded fan remnant* highly dissected by ravines and gullies that can be just a fringe or make up a large part of an eroded alluvial fan; its bounding escarpments (risers), originally formed by inset channels, have become highly dissected and irregular such that terrace components (tread and riser) have been consumed or modified and replaced by hillslope positions and components (shoulder, backslope, footslope, etc.); sometimes referred to as *fan remnant sideslopes* (FFP). Compare – eroded fan remnant. SW & FFP

**erosion** - The wearing away of the land surface by running water, waves, or moving ice and wind, or by such processes as mass wasting and corrosion (solution and other chemical processes). The term "geologic erosion" refers to natural erosion processes occurring over long (geologic) time spans. "Accelerated erosion" generically refers to erosion in excess of what is presumed or estimated to be naturally occurring levels, and which is a direct result of human activities (e.g. cultivation, logging, etc.). SW & HP

**erosional** [geomorphology] - (adjective) Owing its origin, form, position or general character to

degradational processes by water, wind, ice or gravity. Compare - constructional. HP

**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

**estuarine tidal stream** – A subaqueous, depositional landform composed of a clearly defined channel, creek, stream, river, or basin entering into “mainland coves” and surrounded on three sides by the mainland associated with the larger estuary. These areas are influenced by the ebb and flow of the tide, where freshwater from the upstream mainland areas flows seaward and contests with the saltwater flows that move landward. Sediments commonly contain sequestered woody swamp materials (e.g. stumps, etc.). PK, SW

**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 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 stream 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., rockfall, 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. Syn.: bajada. FFP

**fan remnant** - A general term for landforms that are the remaining parts of older, **non-active** 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). A ~~erosional~~ fan remnant must retain a relatively flat summit that is a relict fan-surface (>50% intact). A nonburied fan-remnant is a relict surface in its entirety. Compare – eroded fan remnant, **eroded fan remnant sideslope**, 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. Compare fault-block mountains. 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 zone**, 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, and the understory is dominantly saw palmetto). Hydrogeologically 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) **(not preferred; refer to basin floor, valley floor)**. A general term for the nearly level, lower part of a basin or valley; (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

**flow till** - A till, that may be either subglacial or supraglacial in origin. Flow till displays secondary transport, sorting, and/or fabric modification by plastic mass flow. Flow till exhibits weak stratification and sorting and may contain distorted layers indicative of lateral displacement and soft sediment deformation. The secondary flow processes obliterate most original till fabric and clast orientation in the till. Compare - subglacial till, supraglacial till, lodgment till, melt-out till. SW, 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 interfluve 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

**fold-thrust hills** - A landscape along an orogenic belt margin underlain dominantly by sedimentary rocks that have undergone intensive structural deformation via a series of sub-parallel thrust faults and associated folds. The thrust faults typically merge along a regional, subhorizontal displacement (decollement) at the basement contact. The land area displays considerable relief, characterized by *cuestas*, hogbacks, strike valleys, dip slopes, scarp slopes, and structurally-controlled hills; also known as an overthrust belt (e.g. the Wyoming overthrust belt). SW & 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 - interfluvial, 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 the *interfluve* (stable summit area); *crest* (unstable summit, converged shoulders); three geomorphic slope areas defined by plan shape and its influence on overland flow and throughflow: *head slope* (convergent flow), *side slope* (parallel flow), *nose slope* (divergent flow) *free face* (rock outcrop); and the *base slope* (concave accretion area: colluvium / slope alluvium apron 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; **a type of patterned ground**. 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. GG

**glacial lake [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 its 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 IUGS classification, a preliminary term for (for field use) for a plutonic rock with Q (quartz) between 20 and 60 (%). 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** – **A generic name for** 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. **Fine gravels and sands commonly consist of relatively unweathered, very hard mineral crystal fragments.** 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** - [channel] A tidal stream connecting two larger waterways within a lagoon, estuary or bay; also called a tidal channel. SW & GG

**gut** - [valley] (colloquial: U.S. Virgin Islands, Caribbean Basin) A gully, ravine, small valley, or narrow passage on land. SW & GG

**gypsite** – An earthy gypsum ( $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ ) variety that contains various quantities (i.e. < 50%) of soil material, silicate clay minerals and sometimes other salts (e.g. NaCl); found only in arid or semi-arid regions as secondary precipitation concentrations or efflorescence associated with rock gypsum or gypsum-bearing strata. Compare – rock gypsum, rock anhydrite. 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, interfluve, crest, base slope. SW

**headwall [anthropogenic]** - A sheer slope or cliff face at the head of an excavation; e.g. the rock cliff at the active face of a mine, pit, or quarry, from which material has been extracted; also called a highwall. SW & ICOMANTH

**headwall [glacial]** - 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

**highwall** – see *headwall [anthropogenic]*.

**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** – [**Anthropogenic**] 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, **rice paddy**. SW & GSST

**hillslope terrace anthroscape** – A human-modified “landscape” dominated by permanent alterations to the physical shape and /or internal stratigraphy of the land (i.e. complexes of **large** berms or walls and artificial terraces on sloping land), due to management for food or fiber production that have substantively altered water flow and sediment transport across or within the regolith; **a type of agricultural anthroscape**. Commonly excludes areas of minor alterations (e.g. low berms, shallow troughs or furrows) that are easily obscured or

obliterated by natural bio-, pedo-, or cryoturbation. Compare –urban anthroscape, suburban anthroscape. SW

**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** - An epoch of the Quaternary Period of geologic time that follows 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** – An intermediate form of homocline that forms an asymmetric ridge with a dip slope commonly between 10 – 25° (15 – 45 %). A homoclinal ridge has steeper dip than a cuesta but less 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 artifact** – (not preferred) see *artifact*.

**human - transported material** – Organic or mineral 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 reworking by wind, gravity, water, or ice. Human transported materials are most commonly 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; **see hummock - [patterened ground]**) 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 pressure ridge** – 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

**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

**interfurrow** – A low, commonly linear or arcuate ridge of soil mounded between furrows by a plow or other farm equipment and serves as a slightly elevated bedding area for planted crops; also called row, tillage row, tillage ridge, tillage mound. Interfurrows range from narrow and peaked (tillage ridge) to broad and flat-topped; size and shape depends upon how the elevated areas are made and the crop grown. Compare – furrow. 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]** – The subsurface location and morphology of the nearly level, transitional area (microslope) between an upwelling morphology (chimney) under a slightly elevated microhigh (i.e. microknoll; *mound* in Russia) and the bowl morphology under an adjacent microlow (i.e. microbasin, microtrough; *depression* in Russia) in gilgai or other patterned ground. It can make up a majority of the ground area in gilgai. Compare – chimney, bowl, microslope, 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 or bench 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.

**lagoon [relict]** - A subaerial, nearly level, filled trough or depression originally formed behind a longshore bar on a barrier beach and built by a receding pluvial or glacial lake. Compare - sewage lagoon, pluvial lake. SW & 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 landform and sediments (*lahar deposit*), emplaced by and process associated with a mudflow on or near the flank of a volcano that is composed mainly of volcanoclastic debris. Sediment composition includes pyroclastic material, primary lava-flow blocks and fragments, and nonvolcanic material. Thick lahar deposits may have crude (poorly sorted) upward-fining strata. A lahar is initially unconsolidated material, but through cementation and compression can become bedrock. Compare – mudflow, andesitic lahar, lahar deposit. SW & GG

**lahar deposit** – The unconsolidated sediments emplaced by a lahar. The sediment composition includes pyroclastic material, primary lava-flow blocks and fragments, and nonvolcanic material. SW

**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** - The bottom of a lake; a lake basin. GG

**lakebed [relict]** The flat to gently undulating ground underlain or composed of fine-grained sediments deposited in a former lake. GG

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

**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 range in size (e.g., *dune* encompasses a number of features including *parabolic dune*, which is several tens-of-meters long, and *seif dune* which can be up to 100 kilometers long. Landforms provide an empirical description of similar portions of the earth's surface features. SW & GG

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

**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, earthfall), *topple* (rock topple, debris topple, earth 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], volcanic block, 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. Compare – aa lava, block lava, pahoehoe lava, pillow lava. GG

**lava channel** – see lava trench.

**lava dome** – A rounded or irregular mound, hill or small mountain composed of lava congealed over a volcanic vent on the flanks or within a crater or caldera. Typically composed of silica-rich volcanic rocks (e.g. rhyolite, dacite) with admixtures of obsidian, agglomerate, volcanic breccia, etc.). The lava may be uniform or varied in color and texture; also called a resurgent dome. SW, HS, & GG

**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 - aa 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*.

**limonite** – A general “field” term for various brown to yellowish brown, amorphous- to-cryptocrystalline hydrous ferric oxides that are an undetermined mixture of goethite, hematite, and lepidocrocite formed by weathering and iron oxidation from iron-bearing, rocks and minerals. SW & GG

**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** – An informal term referring to the collective, relative differences in elevation of a land surface between drainageways or local depressions and adjacent elevated Landforms ( on a local scale). Compare - relief, Microrelief. SW

**lodgment till** - A subglacial till deposited by an active glacier (flowing ice) commonly characterized by dense, fissile ("platy") structure and containing rock fragments with their long axes oriented generally parallel to the direction of ice flow. Local bedrock generally dominates the rock fragment composition and fragments exhibit striations or facets. Compare - till, supraglacial till, flow till, melt-out till. SW, GG

**loess** - Material transported and deposited by wind and consisting predominantly of silt-size particles. Commonly a loess deposit thins and the mean-particle size decreases as distance from the source area increases. Loess sources are dominantly from either glacial meltwaters (i.e. "cold loess") or from non-glacial, arid environments, such as deserts (i.e. "hot loess"). [soil survey] Several types of loess deposits can be recognized based on mineralogical composition (calcareous loess, non-calcareous loess). SW & GSST

**loess bluff** - A bluff composed of a thick deposit of coarse loess, formed immediately adjacent to the edges of flood plains, as along the Mississippi River valley or China. Sometimes referred to as a bluff formation (not preferred). SW & GG.

**loess hill** - A hill composed of thick deposits of loess, as in IA, MO, NE and the Palouse Hills of WA & ID. SW

**log landing** – A comparatively level area, usually with road access, constructed or cut into steeper slopes and used for sorting logs during timber harvest operations. Compare – skid trail. SW

**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** - A low, elongate sand ridge, built chiefly by wave action, occurring at some distance from, and extending generally parallel with, the shoreline, and submerged at least by high tides, and typically separated from the beach by an intervening trough. GG

**longshore bar [relict]** - A narrow, elongate, wave-built sand ridge that originally rose near to, or barely above, the surface of a body of water, and extended generally parallel to the shore but separated from it by an intervening trough. SW & 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** - (not preferred - refer to tidal 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. stingless 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, and deeper narrower, and more stable channel cross sections than braided streams. Compare - meander, braided stream, flood-plain landforms. HP & RR

**meander scar** - (a) A crescent-shaped, concave or linear mark on the face of a bluff or valley wall, produced by the lateral erosion of a meandering stream which impinged upon and undercut the bluff; if it's no longer adjacent to the modern stream channel it indicates an abandoned route of the stream. SW; (b) (not 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** – A till that may be either subglacial or supraglacial in origin. Melt-out till forms by slow melting of debris-rich stagnant ice, but without secondary flow processes. Thus, the fabric and clast

orientations imparted by ice processes remain mostly intact. . Compare - subglacial till, supraglacial till, flow till, lodgment till. SW & GG

**mesa** - An isolated, flat-topped, landform that stands distinctly above the adjacent land area and is bounded by steep slopes or cliffs; and is generally capped by erosion-resistant, nearly horizontal rock (often lava). Mesas and buttes have similar forms and isolated occurrence. A mesa has a summit area broader than the bounding cliff height. Mesas are most common in arid and semi-arid regions, but are not climatically restricted. Compare - butte, plateau, cuesta. SW & 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; obsolete) A slope that is relatively stable at the present time, but may become active if the environmental balance is disturbed, for instance, by road construction or destruction of vegetation. A metastable slope is often related to base levels of former geomorphic episodes. The regolith is generally moderately deep, may contain stone lines or relict evidence of slope alluvium. Slope gradients usually range from 15 to 45 %. Compare – active slope. HP

**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). They are readily identifiable at ground level and typically have substantial impact on local soil geography, local hydrology, and ecological microsites. 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 differences 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); differences 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*, *microslope*, *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

**microslope** - A generic Microrelief term applied to areas of nominal surface relief (slightly sloping to level), relative to the adjacent ground surface; differences in overall local relief range from several centimeters to several meters. Cross-sectional profiles can be simple or complex and generally consist of low and gently rounded, convex tops (*microhigh*) with gently sloping to level sides (*microslope*), and depression low areas (*microlow*). Microslopes commonly constitute the majority of the land surface area in gilgai and other settings with microrelief. SW.

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 (from approximately 5.2 million 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

**nearshore zone** - A subaqueous marine or lacustrine landform area that generally parallels the shore and extends seaward or lakeward from the low water line to beyond the breaker zone including longshore bars. In the nearshore zone, waves steepen, break, and reform during passage to the beach. Sediment transport occurs both along and perpendicular to the shore via wave and current action. Compare – nearshore zone [relict]. SW & RF

**nearshore zone [relict]** - A former nearshore zone now subaerially exposed due to isostatic rebound or

glacial lake drainage. Commonly a raised beach marks the former landward edge of a relict near shore zone and relict longshore bars may exist in offshore positions. Surficial sediments may display evidence of wave and current action such as sorting or particle-size discontinuities. SW

**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

**Occam's Razor** - The philosophical principle of *parsimony*: the simplest explanation of natural phenomena (or the use of the minimum number of assumptions) until new information requires otherwise, is most likely the correct one; also spelled Ockham's. 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** –An epoch of the Tertiary Period of geologic time (from 23.3 to 35.4 million years ago), which follows the Eocene Epoch 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

**overthrust belt** – not preferred; use *fold-thrust hills*.

**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 - aa 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 - aa 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, terrace 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 back slope 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° 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**

**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**

**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 – aa 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 aa 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 broad, flat, lowland area, large or small, of low relief. Specifically, any extensive region of comparatively smooth and level to 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, cropped, grasslands or barren and may be formed by deposition or erosion. Compare - lowland, plateau. SW & 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), that follows the Pliocene Epoch and precedes 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, following the Miocene Epoch and preceding the Pleistocene Epoch; also, the corresponding (time-stratigraphic) "series" of earth materials. HP

**plow pan** – [soil survey] A relatively thin, highly compressed soil layer at the depth of tillage (e.g. 8-25cm), largely the result of driving tractor wheels in a furrow while plowing. It can dramatically reduce vertical root penetration, water percolation, internal gas exchange and subsequent crop growth; sandy loam soil textures are particularly susceptible. SW, GSST

**plug [volcanic]** – not preferred – refer to *volcanic plug*. 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 an extended period of exceptionally heavy rainfall, **commonly the Pleistocene**. Compare – **playa lake**, pluvial lake [relict], glacial lake, proglacial lake. SW & GG

**pluvial lake [relict]**- A lake formed in an extended period of exceptionally heavy rainfall but now greatly reduced or gone; a lake formed in the Pleistocene Epoch during a time of glacial advance **(and associated increase in annual precipitation**

**or runoff)**, and now extinct (relict) e.g., Lake Bonneville. Compare – pluvial lake, **playa**, glacial lake, proglacial lake. SW & GG

**pocosin** - (colloquial: southeastern U.S.A.) A large wet area on broad, commonly a swamp, which occurs on nearly level interfluvies 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

**polder** – A generally fertile tract of flat, low-lying coastal area that is at or below sea level but has been reclaimed and is constantly protected from the sea, or other body of water by an organized system of embankments, dikes, dams, or levees; e.g., a brackish marsh that has been drained and brought under cultivation SW & ICOMANTH

**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

**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 (e.g. carbonates) forced to the surface and crops out on a low mound or rim (e.g. microhigh); the surface exposure of a chimney [gilgai]; a type of diapir composed of earthy material. Compare - chimney, microslopes, 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 high concentration of pyroclastic particles in a variety of sizes and composition (ash, pumice, scoria, lava fragments, etc.); produced by the explosive disintegration of viscous lava in a volcanic crater, collapse of an eruption column, 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 and comparatively low concentrations of pyroclastic particles (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

**reclaimed mineland anthroscape - A human-modified "landscape" with substantial, permanent alterations to the physical shape and/or internal stratigraphy of the land due to restoration efforts of a large surface mine (e.g., coal mine) that have substantively altered water flow and sediment transport across and within the regolith. Small dry pits and depressions may remain mixed in with reclaimed fill. Compare - resource extraction anthroscape, hillslope terrace anthroscape, suburban anthroscape, and urban anthroscape. 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** - (not preferred) see *tidal inlet [relict]*.

**relief** - The relative difference in elevation between the upland summits and the lowlands or valleys of a given region (broad scale). 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

**resource extraction anthroscape - A human-modified "landscape" dominated by substantial,**

**permanent alterations to the physical shape and/or internal stratigraphy of the land due to removal of materials (e.g., un-reclaimed or unfilled surface mines / quarries, typically intercepting and partially filled with groundwater) that have substantively altered water flow and sediment transport across and within the regolith. Commonly excludes areas of minor alterations (e.g. farm ponds and small reservoirs) that are designed impoundments of surface water. Compare – reclaimed mineland anthroscape, hillslope terrace anthroscape, suburban anthroscape, and urban anthroscape. SW**

**reworked lake plain** – (obsolete) see *till-floored lake plain*.

**rhythmite** - An individual unit of a succession of beds developed by rhythmic sedimentation; e.g. a cyclothem. The term implies no limit as to the 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-elevation 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** - [soil survey] A general term for a slight increase in slope (e.g.  $\leq 3\%$ ) and elevation of the land surface, usually with a broad, low summit and gently sloping sides. The term is restricted to landforms and microfeatures in areas of very low relief such as the High Plains, lake plains or coastal plains. SW & GG

**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. 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. Compare – road cut. 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

**rock anhydrite** – A sedimentary rock (evaporite) composed chiefly of mineral anhydrite (anhydrous  $\text{CaSO}_4$ ); The rock is generally massive, cryptocrystalline, and may exhibit rhythmic sedimentation (rhymites). Compare – rock gypsum, rock halite. SW

**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 gypsum** - A sedimentary rock (evaporite) composed primarily of mineral gypsum ( $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ ). The rock is generally massive, ranges from coarse crystalline to fine granular, may show disturbed bedding due to hydration expansion of parent anhydrite (anhydrous  $\text{CaSO}_4$ ), and may exhibit rhythmic sedimentation (rhymites). Compare – gypsite. GG

**rock halite** - A sedimentary rock (evaporite) composed primarily of halite ( $\text{NaCl}$ ). SW

**rock pediment** – An erosion surface of low relief, cut directly into and across bedrock and composed of either bare rock or thinly veneered pedisediment 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 **red, orange-yellow to black** shiny film or coating, composed of iron oxide accompanied by traces of **iron and** 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; **also called desert varnish, desert patina.** GG, RF

**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

**sabkha** - A flat area of eolian sedimentation and erosion formed under semiarid or arid conditions in a) interior areas (e.g. on basin floors) slightly above playa lake beds (e.g. playa step), or b) along coastal areas (e.g., just above intertidal zones), where, through deflation and evaporation, gypsum, halite, or other soluble minerals crystallize at or near the surface to form a thin, irregular mineral crust that is intermittently deflated away. Microbiotic crusts are not extensive and vegetation is very sparse and consists primarily of small, halophytic shrubs (e.g. iodine bush). SW, RF, & 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*.

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

**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 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. 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] - The process of 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. 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

**scour channel** - A large, groove-like erosional feature in a stream bed swept (scoured) by running water, generally leaving a gravel bottom. 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 Salton Sea, CA). b) A geographic subdivision of an ocean (e.g. the South China Sea). Compare – gulf, ocean. GG

**sea cliff** - 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 *terraces*.

**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). 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

**slackwater** - A quiet part of, or a still body of water in a stream. Compare - backswamp. GG

**slickrock** - (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

**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 recommended; obsolete) refer to *rotational slide*.

**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 *terraces*.

**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 moved slowly down slope en masse, caused by the melting of seasonal frost or permafrost, resulting in an over-thickened leading edge of linear, lobate, or irregular forms that loosely parallel or obliquely follow the slope contour; may be superficially armored by coarse fragments on the leading margin. 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 klufkarren (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 volcanics 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 km<sup>2</sup>) 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

**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

**strait** - 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 stepped series of flat-topped landforms of alluvium in a stream valley, that flank and are parallel to the stream channel. Originally formed by a previous stream level, and representing the 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 remnant. 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 subsequent stream. 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 ( $< 2^{\circ}$ ) 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

**structural back slope** - (not recommended) use *dip slope*.

**structural bench** - A shelf or step-like landform produced or controlled by erosion resistant, horizontally-bedded rock. Erosion removes overlying weaker rock or sediment forming a nearly level to gently inclined surface that rests on a relatively resistant strata or rock that ascends to a higher slope or platform. Structural benches may occur as a single feature or as a series of stepped-surfaces where alternating weak and resistant strata exist. Due to erosion resistance, structural benches may have little or no geomorphic implication regarding fluvial deposition, past erosion cycles or former stream, basin, or base levels. - Compare – mesa, pediment, ledge; see scarp. SW

**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** (adj.) (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 flow till** - (not preferred- refer to flow till).

**subglacial melt-out till** - (not preferred- refer to melt-out till).

**subglacial till** – Till deposited beneath, in or by the bottom parts of a glacier or ice sheet; subglacial till types include lodgment till, subglacial flow till, and subglacial melt-out till. SW & GM

**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** - [coast] The submerged extension of an exposed (subaerial) point bar. SSS

**submerged-upland soil** – Mineral or organic soil that primarily formed in a subaerial setting but is now under water, commonly in intertidal or subaqueous settings. Inundation could occur for various reasons (e.g., sea-level rise in a marine or estuarine system or ponding from a dam). In intertidal settings, tidal marsh soils may occur above former subaerial soils (see *submerged-upland tidal marsh*). In subaqueous settings (permanently submerged), submerged-upland soils typically occur below a cap of subaqueous soil forming in the subaqueous environment. SW

**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 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

**subsoil (also topsoil, substratum)**

**substratum (also topsoil, subsoil)**

**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

**suburban anthroscape - A human-modified “landscape” with substantial, permanent alterations to the physical shape and /or internal stratigraphy of the land due to management for habitation or commerce that have substantively altered water flow and sediment transport across and within the regolith. This includes extensive areas dominated by nominally or non-modified soils in greenspace (yards, parks, riparian buffers), with substantial but secondary areas of impervious surfaces, buildings and roads. Commonly excludes areas of minor alterations (e.g. shallow landscaping) that are easily obscured or obliterated by natural bio-, pedo-, or cryoturbation. Compare –hillslope terrace anthroscape, and urban anthroscape. SW**

**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** – (adj.) 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 flow till** - (not preferred- refer to flow till).

**supraglacial melt-out till** - (not preferred - refer to melt-out till)

**supraglacial till** - Till deposited on top of or within the upper part of a glacier or ice sheet. Melting of glacial ice deposits supraglacial till atop subjacent material, which forms topographic highs on a resultant landscape. Supraglacial till types include supraglacial flow till and supraglacial melt-out till. Compare – till, subglacial till.. SW & GM

**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 drainageway. 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) or broad, dominantly planar upland plains bounded or dissected by large streams or rivers. Compare - plateau, mesa, cuesta. SW & 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], volcanic blocks; > 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.

**terrace [soil survey]** – not used except as an informal abbreviation (shorthand) for stream terrace. Practically, terraces are considered to be generally flat alluvial areas above the 100 yr. flood stage. SW

**terrace remnant** – A stream terrace eroded and dissected to such an extent that it occurs as a scattered and isolated geomorphic surface generally on interfluvial noses, **bounded by erosional slopes or valley sides** above a younger, more continuous stream terrace. A continuous tread surface no longer exists, but alluvium is present in or below the soil profile. In contrast to a paleoterrace, a terrace remnant corresponds to the present-day drainage system. Compare – stream terrace. 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 (approximately 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 inlet [relict]** - A channel remnant of a former tidal inlet. The channel was cutoff or abandoned by infilling from migrating shore sediments. Compare – inlet, tidal inlet. SW & SSS

**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

**tillage mound** - Refer to *interfurrow*.

**till-floored lake plain** – [soil survey] A glaciated land area that has characteristics of a till plain, but that was also inundated by a glacial lake. The area possesses a gently undulating till-topography, rather than a distinctive, low-relief lake plain surface, and has thin (e.g. ≈ 1-3m), continuous or discontinuous lacustrine sediment atop the till. –Topographic that once existed as islands may exhibit shore features (e.g., wave-cut scarps, strandlines, beach deposits). 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

**topsoil (also subsoil, substratum )**

**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 titled, 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 accelerated erosion, excavation, etc., but retains some portion of the original subsoil horizons intact. Compare – scalped area. SW & GSST

**tuff** - A generic term for any consolidated or cemented deposit that is  $\geq 50$  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 (typically 10-50 cm height; 20-90 cm diameter). Groups of hummocks can form a type of patterned ground common to tundra or wet areas (e.g. marsh). Compare - earth hummock, non-sorted circle, patterned ground. NRC & SW

**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

**urban anthroscape** - A human-modified “landscape” dominated by permanent alterations to the physical shape and /or internal stratigraphy of the land due to management for habitation or commerce that have substantively altered water flow and sediment transport across and within the regolith. This includes extensive complexes of impervious surfaces, buildings, and roads, with comparatively minor areas of unmodified or natural land (e.g., parks, recreational land). Commonly excludes areas of minor alterations (e.g. shallow landscaping) that are easily obscured or obliterated by natural bio-, pedo-, or cryoturbation. Compare – agricultural, hillslope terrace anthroscape, and suburban anthroscape. SW

**urban land** – (not preferred) A Miscellaneous Land Type, not a geologic feature; see anthroscape.

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

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

**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 crater** - 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

**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 its original topographic configuration, composition and extent is uncertain. Compare – lava field, lava plain. SW

**volcanic neck** – 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

**volcaniclastic** - 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** – 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

**volcanic pressure ridge** - 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

**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

**water-lain moraine** – A terminal, end, or recessional moraine formed subaqueously by a glacier that terminated in a water body (e.g., glacial lake, sea, or ocean). A water-lain moraine may occur at the present land surface as a result of isostatic rebound or lake drainage. Compared to a land-based moraine of similar origin, a water-lain moraine displays sediment (till) modification by wave and/or current action and has a somewhat subdued topography. 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*.

**wave-worked till plain** – A glaciated land area that has the characteristics of a till plain, but that was also inundated by a glacial lake. The area possesses a gently undulating till-topography rather than a distinctive, low-relief lake plain surface. Lacustrine sediments, however, are absent or occur only sparsely, but a wave/current-modified, surficial mantle may commonly exist atop the till. Topographic highs, which were once islands, may possess shore features (e.g., wave-cut scarps, strandlines, beach deposits). Compare till-floored lake plain. SW

**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.

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**Exhibit 629-1 Comprehensive Alphabetical Lists of Landscape, Landform, Microfeature, and Anthropogenic Features Terms defined in the Glossary**

(subset lists by Geomorphic Process or other groupings). Geomorphic process is a framework for the *Geomorphic Description System* (Schoeneberger and Wysocki, 2012; Soil Survey Manual, 2017).

Note: NR - Not recommended terms (not be used); NP - Not preferred terms (better alternatives exist). Italicized letters that follow terms are short codes (e.g., AP).

**I -- ALPHABETICAL LISTS** (Landscapes, Landforms, Microfeatures, Anthropogenic Features).

**A. LANDSCAPES** (spatially associated regional landform groups or spacially unique landform groups)

alluvial plain	AP	karst	KP
alluvial plain remnant	AR	kegel karst	KK
badlands	BA	lagoon ( <i>water body; also Landform</i> )	LG
bajada ( <i>also Landform</i> )	BJ	lake plain ( <i>also Landform</i> )	LP
barrier island ( <i>also Landform</i> )	BI	lava field ( <i>also Landform</i> )	LF
basin	BS	lava plain ( <i>also Landform</i> )	LV
basin floor ( <i>also Landform</i> )	BC	lava plateau ( <i>also Landform</i> )	LL
batholith	BL	lowland	LW
bay [coast] ( <i>water body; also LF</i> )	BY	marine terrace ( <i>also Landform</i> )	MT
bolson	BO	meander belt	MB
breached anticline ( <i>also Landform</i> )	BD	mountain range	MR
breaklands	BR	mountains ( <i>singular = Landform</i> )	MO
breaks	BK	mountain system	MS
caldera ( <i>also Landform</i> )	CD	ocean ( <i>water body</i> )	OC
canyonlands	CL	outwash plain ( <i>also Landform</i> )	OP
coastal plain ( <i>also Landform</i> )	CP	peninsula	PE
cockpit karst	CPK	piedmont	PI
cone karst	CK	piedmont slope	PS
continental glacier	CG	plains ( <i>also Landform</i> )	PL
<b>coppice dune field</b>	CDF	plateau ( <i>also Landform</i> )	PT
delta plain ( <i>also Landform</i> )	DP	rift valley	RF
dissected breaklands	DB	river valley ( <i>also Landform</i> )	RV
dissected plateau	DI	sandhills	SH
drumlin field	DF	sand plain	SP
dune field	DU	scabland	SC
estuary ( <i>water body; also Landform</i> )	ES	sea ( <i>water body; also Landform</i> )	SEA
everglades	EG	semi-bolson	SB
fan piedmont ( <i>also Landform</i> )	FP	shield volcano ( <i>also Landform</i> )	SV
fault-block mountains	FM	shore complex	SX
fluviokarst	FK	sinkhole karst	SK
fluviomarine terrace ( <i>also Landform</i> )	FT	sound ( <i>water body; also Landform</i> )	SO
fold-thrust hills	FTH	strait ( <i>water body; also Landform</i> )	ST
foothills	FH	tableland	TB
glaciokarst	GK	thermokarst	TK
gulf ( <i>water body; also Landform</i> )	GU	till plain ( <i>also Landform</i> )	TP
hills ( <i>singular = Landform</i> )	HI	tower karst	TW
ice-margin complex	IC	upland	UP
intermontane basin ( <i>also Landform</i> )	IB	valley ( <i>also Landform</i> )	VA
island ( <i>also Landform</i> )	IS	volcanic field ( <i>also Landform</i> )	VF

**B) LANDFORMS** (natural, individual, earth-surface features mappable at soil survey scales)

aa lava flow	ALF	butte	BU
alas	AA	caldera ( <i>also Landscape</i> )	CD
alluvial cone	AC	canyon	CA
alluvial fan	AF	canyon bench	CYB
alluvial flat	AP	canyon wall	CW
alpine glacier	AG	Carolina Bay	CB
anticline	AN	channel ( <i>also Microfeature</i> )	CC
arete	AR	chenier	CG
arroyo	AY	chenier plain	CH
ash field	AQ	cinder cone	CI
ash flo	AS	cirque	CQ
atoll	AT	cirque floor	CFL
avalanche chute	AL	cirque headwall	CHW
axial stream	AX	cirque platform	CPF
back-barrier beach	BBB	cliff	CJ
back-barrier flat	BBF	climbing dune	CDU
backshore	AZ	closed depression ( <i>also Microfeature</i> )	CLD
backswamp	BS	coastal plain ( <i>also Landscape</i> )	CP
bajada ( <i>also Landscape</i> )	BJ	cockpit	COC
ballena	BL	col	CL
ballon	BV	collapse sinkhole	CSH
bar	BR	collapsed ice-floored lakebed	CK
barchan dune	BQ	collapsed ice-walled lakebed	CN
barrier beach	BB	collapsed lake plain	CS
barrier cove	BAC	collapsed outwash plain	CT
barrier flat	BP	colluvial apron	COA
barrier island ( <i>also Landscape</i> )	BI	complex landslide	CLS
basin floor ( <i>also Landscape</i> )	BC	coral island	COR
basin-floor remnant	BD	coulee	CE
bay [coast] ( <i>water body; also Landscape</i> )	BAY	cove	CO
bay [geom.]	BYG	cove [water] ( <i>water body</i> )	COW
bay bottom	BOT	crag and tail	CAT
bayou ( <i>water body</i> )	WC	creep	CRE
beach	BE	crevasse filling	CF
beach plain	BP	cueta	CU
beach ridge	BG	cueta valley	CUV
beach terrace	BT	cutoff	CV
berm	BM	debris avalanche	DA
beveled base	BVB	debris fall	DEF
blind valley	VB	debris flow	DF
block field	BW	debris slide	DS
block glide	BLG	debris spread	DES
block lava flow	BLF	debris topple	DET
block stream	BX	deflation basin	DB
blowout	BY	deflation flat	DEF
bluf	BN	delta	DE
bog	BO	delta plain ( <i>also Landscape</i> )	DC
box canyon	BOX	depression	DP
braided stream	BZ	diapir	DD
breached anticline ( <i>also Landscape</i> )	BRL	diatrema	DT
breaks ( <i>also Landscape</i> )	BK	dike	DK
broad interstream divide	BID	dip slope	DL

disintegration moraine	DM	fold	FQ
distributary	DIS	foredune	FD
divide	DN	fosse	FV
dome	DO	free face ( <i>also Geom. Comp. -Hills, Mountains</i> )	FW
drainageway	DQ	fringe-tidal marsh	FTM
drainhead complex	DRC	gap	GA
draw	DW	geyser	GE
drumlin	DR	geyser basin	GEB
drumlinoid ridge	DRR	geyser cone	GEC
dune	DU	giant ripple	GC
dune field ( <i>also Landscape</i> )	DUF	glacial drainage channel	GD
dune lake ( <i>water body</i> )	DUL	glacial lake ( <i>water body</i> )	WE
dune slack ( <i>also Microfeature</i> )	DUS	glacial lake [relict]	GL
earth spread	ESP	glacial-valley floor	GVF
earth topple	ETO	glacial-valley wall	GVW
earthflow	EF	glacier	GLA
end moraine	EM	gorge	GO
ephemeral stream ( <i>also Microfeature</i> )	EPS	graben	GR
eroded fan remnant	EFR	ground moraine	GM
eroded fan-remnant sideslope	EFS	gulch	GT
erosion remnant	ER	gulf ( <i>water body; also Landscape</i> )	GU
escarpment	ES	gut [channel] ( <i>water body; also Micro</i> )	WH
esker	EK	gut (valley)	GV
<b>estuarine tidal stream (<i>also Micro</i>)</b>	<b>ETS</b>	half graben	HG
estuary ( <i>water body; also Landscape</i> )	WD	hanging valley	HV
faceted spur	FS	headland	HE
fall	FB	head-of-outwash	HD
falling dune	FDU	headwall	HW
fan	FC	high hill	HH
fan apron	FA	highmoor bog	HB
fan collar	FCO	hill ( <i>plural = Landscape</i> )	HI
fan piedmont ( <i>also Landscape</i> )	FG	hillslope	HI
fan remnant	FH	hogback	HO
fan skirt	FI	homoclinal ridge	HCR
fanhead trench	FF	homocline	HC
fault-block	FAB	horn	HR
fault-line scarp	FK	horst	HT
fault zone	FAZ	hot spring	HP
fen	FN	ice pressure ridge	IPR
fissure vent	FIV	ice-contact slope	ICS
fjord ( <i>water body</i> )	FJ	ice-marginal steam	IMS
flat	FL	ice-pushed ridge	IPU
flatwoods	FLW	inlet	IL
flood plain	FP	inselberg	IN
flood-plain playa	FY	inset fan	IF
flood-plain splay	FM	interdrumlin	IDR
flood-plain step	FO	interdune ( <i>also Microfeature</i> )	ID
flood-tidal delta	FTD	interfluves ( <i>also Geom.Component - Hills</i> )	IV
flood-tidal delta flat	FTF	interior valley	INV
flood-tidal delta slope	FTS	intermittent stream ( <i>also Microfeature</i> )	INT
flow	FLO	intermontane basin ( <i>also Landscape</i> )	IB
flute ( <i>also Microfeature</i> )	FU	island ( <i>also Landscape</i> )	IS
fluviomarine bottom	FMB	kame	KA
fluviomarine terrace ( <i>also Landscape</i> )	FMT	kame moraine	KM

kame terrace	KT	medial moraine	MH
karst cone	KC	mesa	ME
karst lake	KAL	meteorite crater	MEC
karst tower	KTO	mogote	MOG
karst valley	KV	monadnock	MD
karstic marine terrace	KMT	monocline	MJ
kettle	KE	moraine	MU
kipuka	KIP	mountain ( <i>plural = Landscape</i> )	MM
knob	KN	mountain slope	MN
knoll	KL	mountain valley	MV
lagoon ( <i>water body; also Landscape</i> )	WI	mud pot	MP
lagoon [relict]	LAR	mudflow	MW
lagoon bottom	LBO	muskeg	MX
lagoon channel	LCH	natural levee	NL
lahar	LA	nearshore zone	NZ
lake ( <i>water body</i> )	WJ	nearshore zone [relict]	NZR
lake plain ( <i>also Landscape</i> )	LP	notch	NO
lake terrace	LT	nunatak	NU
lakebed	LB	open depression ( <i>also Microfeature</i> )	ODE
lakebed [relict]	LBR	outwash delta	OD
lakeshore	LF	outwash fan	OF
landslide	LK	outwash plain ( <i>also Landscape</i> )	OP
lateral moraine	LM	outwash terrace	OT
lateral spread	LS	overflow stream channel	OSC
lava dome	LD	oxbow	OX
lava field ( <i>also Landscape</i> )	LFI	oxbow lake ( <i>water body</i> )	WK
lava flow	LC	paha	PA
lava flow unit ( <i>also Microfeature</i> )	LFU	pahoehoe lava flow	PAF
lava plain ( <i>also Landscape</i> )	LN	paleoterrace	PTR
lava plateau ( <i>also Landscape</i> )	LL	parabolic dune	PB
lava trench ( <i>also Microfeature</i> )	LTR	parna dune	PD
lava tube	LTU	partial ballena	PF
ledge	LE	patterned ground	PG
levees	LV	pavement karst	PAV
loess bluff	LO	peak	PK
loess hill	LQ	peat plateau	PJ
longitudinal dune	LDU	pediment	PE
longshore bar	LON	perennial stream ( <i>water body; also Micro</i> )	PS
longshore bar [relict]	LR	pillow lava flow	PIF
louderback	LU	pingo	PI
low hill	LH	pinnacle	PIN
lowmoor bog	LX	pitted outwash plain	PM
maar	AA	pitted outwash terrace	POT
main scarp ( <i>also Microfeature</i> )	MAS	plain ( <i>plural = Landscape</i> )	PN
mainland cove	MAC	plateau ( <i>also Landscape</i> )	PT
mangrove swamp	MAN	playa	PL
marine lake ( <i>water body</i> )	ML	playa dune ( <i>also Microfeature</i> )	PDU
marine terrace ( <i>also Landscape</i> )	MT	playa floor ( <i>also Microfeature</i> )	PFL
marsh	MA	playa lake ( <i>water body</i> )	WL
mawae	MAW	playa rim ( <i>also Microfeature</i> )	PRI
meander	MB	playa slope ( <i>also Microfeature</i> )	PSL
meander scar	MS	playa step ( <i>also Microfeature</i> )	PST
meander scroll	MG	plug dome	PP
meandering channel	MC	pluvial lake ( <i>water body</i> )	PLL

pluvial lake [relict]	PQ	sill	RT
pocosin	PO	sinkhole	SH
point bar	PR	slackwater ( <i>water body</i> )	WS
point bar [coastal]	PRC	slickrock ( <i>also Microfeature</i> )	SLK
pothole ( <i>also Microfeature</i> )	PH	slide	SJ
pothole lake ( <i>water body</i> )	WN	slot canyon	SLC
proglacial lake ( <i>water body</i> )	WO	slough ( <i>water body</i> )	SL
proglacial lake [relict]	PGL	slump block	SN
pyroclastic flow	PCF	snowfield	SNF
pyroclastic surge	PCS	soil fall	SOF
raised beach	RA	solution platform	SOP
raised bog	RB	solution sinkhole	SOS
ravine	RV	sound ( <i>water body; also Landscape</i> )	SO
recessional moraine	RM	spit	SP
reef	RF	spur	SQ
ribbed fen	RG	stack [coast]	SRC
ridge	RI	stack [geom]	SR
rim	RJ	star dune	SDU
rise ( <i>also Micro; and Geom. Com.t –Flat Plains</i> )	RIS	steptoe	ST
river ( <i>water body</i> )	RIV	stock	STK
river valley ( <i>also Landscape</i> )	RVV	stoss and lee	SAL
roche moutonnée ( <i>also Microfeature</i> )	RN	strait ( <i>water body; also Landscape</i> )	STT
rock glacier	RO	strand plain	SS
rock pediment	ROP	strath terrace	SU
rock spread	ROS	stratovolcano	SV
rock topple	ROT	stream ( <i>water body</i> )	STR
rockfall ( <i>also Microfeature</i> )	RO	stream terrace	SX
rockfall avalanche	RFA	strike valley	STV
rotational debris slide	RDS	string bog	SY
rotational earth slide	RES	structural bench	SB
rotational rock slide	RRS	submerged back-barrier beach	SBB-
rotational slide	RTS	submerged mainland beach	SMB
sabkha	SAB	submerged point bar [coastal]	SPB
saddle	SA	submerged wave-built terrace	SWT
sag ( <i>also Microfeature</i> )	SAG	submerged wave-cut platform	SWP
sag pond ( <i>water body, also Microfeature</i> )	SGP	submerged-upland tidal marsh	STM
salt marsh	SM	swale ( <i>also Microfeature</i> )	SC
salt pond ( <i>water body also Microfeature</i> )	WQ	swallow hole	TB
sand flow ( <i>also Microfeature</i> )	RW	swamp	SW
sand ramp	SAR	syncline	SZ
sand sheet	RX	talus cone	TC
scarp	RY	talus slope	TAS
scarp slope	RS	tarn ( <i>water body; also Microfeature</i> )	TAR
scree slope	SCS	terminal moraine	TA
sea ( <i>water body; also Landscape</i> )	SEA	terrace	TE
sea cliff	RZ	terrace remnant	TR
seep	SEE	thermokarst depression	TK
seif dune	SD	thermokarst lake ( <i>water body</i> )	WV
semi-open depression	SOD	tidal flat	TF
shield volcano ( <i>also Landscape</i> )	SHV	tidal inlet	TI
shoal ( <i>water body</i> )	WR	tidal inlet [relict]	TIR
shoal [relict]	SE	tidal marsh	TM
shore	SHO	till plain ( <i>also Landscape</i> )	TP
shore complex	SHC	till-floored lake plain	TLP

toe ( <i>also Microfeature</i> )	TOE	volcanic cone	VC
tombolo	TO	volcanic crater	CR
topple	TOP	volcanic dome	VD
tor	TQ	volcanic field ( <i>also Landscape</i> )	VOF
Toreva block	TOR	volcanic neck	VON
translational debris slide	TDS	volcanic pressure ridge ( <i>also Microfeature</i> )	PU
translational earth slide	TES	volcano	VO
translational rock slide	TRS	V-shaped valley	VV
translational slide	TS	wash	WA
transverse dune	TD	washover fan	WF
trough	TR	washover-fan flat	WFF
tunnel valley	TV	washover-fan slope	WFS
tunnel-valley lake ( <i>water body</i> )	TVL	water-lain moraine	WM
underfit stream	US	wave-built terrace	WT
U-shaped valley	UV	wave-cut platform	WP
valley	VA	wave-worked till plain	WW
valley flat	VF	wind gap	WG
valley floor	VL	window	WIN
valley side	VS	wind-tidal flat	WTF
valley train	VT	yardang ( <i>also Microfeature</i> )	YD
valley-border surfaces	VBS	yardang trough ( <i>also Microfeature</i> )	YDT
valley-floor remnant	VFR		

**C MICROFEATURES** (discrete, natural, earth-surface features too small to delineate at survey scales).**1) Common Microfeatures** (*not used in association with the Landform “Patterned Ground”*).

bar	BA	pothole ( <i>also Landform</i> )	PH
channel ( <i>also Landform</i> )	CH	rib	RB
closed depression ( <i>also Landform</i> )	CD	rill	RL
corda	CO	ripple mark	RM
cutter	CU	rise	RIS
dune slack ( <i>also Landform</i> )	DS	( <i>also Landform; and Geom. Comp.– Flat Plains</i> )	
dune traces	DT	rouche moutonnée ( <i>also Landform</i> )	POC
earth pillar	EP	rockfall ( <i>also Landform</i> )	ROF
<b>estuarine tidal stream (also Micro)</b>	<b>ETS</b>	sag ( <i>also Landform</i> )	SAG
ephemeral stream ( <i>also Landform</i> )	ES	sag pond ( <i>water body; also Landform</i> )	SP
finger ridge	FR	sand boil	SB
flute ( <i>also Landform</i> )	FL	sand flow ( <i>also Landform</i> )	RW
frost boil	FB	seep ( <i>also Landform</i> )	SE
glacial groove	GG	shoreline	SHO
groove	GR	shrub-coppice dune	SCD
gully	GU	slickrock ( <i>also Landform</i> )	SLK
gut ( <i>channel; water body; also Landform</i> )	WH	slip face	SF
hillock	HI	solifluction lobe	SOL
hoodoo	HO	solifluction sheet	SS
ice wedge	IWD	solifluction terrace	ST
ice wedge cast	IWC	solution chimney	SCH
interdune ( <i>also Landform</i> )	ID	solution corridor	SCO
intermittent stream ( <i>water body; also Landform</i> )	INT	solution fissure	SOF
karren	KA	solution pipe	SOP
lava flow unit ( <i>also Landform</i> )	LFU	splatter cone	SPC
lava trench ( <i>also Landform</i> )	LT	spiracle	SPI
main scarp ( <i>also Landform</i> )	MAS	strandline	SL
minor scarp	MIS	swale ( <i>also Landform</i> )	SW
mound	MO	swash zone	SZ
navation hollow	NH	tank ( <i>water body</i> )	TA
open depression ( <i>also Landform</i> )	OP	tarn ( <i>water body; also Landform</i> )	TN
patterned ground ( <i>see below</i> )	PG	terraces	TER
perennial stream ( <i>water body; also Landform</i> )	PS	thermokarst depression ( <i>also Landform</i> )	TK
pinnacle	PI	toe [mass movement] ( <i>also Landform</i> )	TOE
playa dune ( <i>also Landform</i> )	PD	tree-tip mound	TTM
playa floor ( <i>also Landform</i> )	PF	tree-tip pit	TTP
playa rim ( <i>also Landform</i> )	PR	tumulus ( <i>tumuli = plural</i> )	TU
playa slope ( <i>also Landform</i> )	PSL	vernal pool ( <i>seasonal water body</i> )	VP
playa step ( <i>also Landform</i> )	PST	volcanic pressure ridge	VPR
playette	PL	yardang ( <i>also Landform</i> )	YD
pond ( <i>water body</i> )	PON	yardang trough ( <i>also Landform</i> )	YDT
pool ( <i>water body</i> )	POO	zibar	ZI

**2) Periglacial patterned ground Microfeatures** [Singular forms (e.g. *circle*) are used for a single feature (pedon scale) whereas plural forms (e.g. *circles*) are used for map unit components].:

circle	CI	palsa (= <i>peat hummocks</i> )	PA
earth hummock	EH	polygon	PYG
high-center polygon	HCP	sorted circle	SCI
ice wedge polygon	IWP	stripes	STR
low-center polygon	LCP	turf hummocks	TH
non-sorted circle	NSC		

- 3) **Other** “patterned ground” Microfeatures [Singular forms (e.g. *hummock*) are used for a single feature (pedon scale) whereas plural forms (e.g. *hummocks*) are used for map unit components]. :

bar and channel	<i>BAC</i>	linear gilgai	<i>LG</i>
circular gilgai	<i>CG</i>	mima mound	<i>MM</i>
elliptical gilgai	<i>EG</i>	pimple mound	<i>PM</i>
gilgai	<i>GI</i>	puff	<i>PU</i>
hummock	<i>HU</i>		

**D) ANTHROSCAPES** [ Large, discrete, artificial (human-made or modified) “landscapes”. ]

anthroscape	ANT	reclaimed mineland anthroscape	RCT
agricultural anthroscape	AGT	resource extraction anthroscape	RXT
hillslope terrace anthroscape	HAT	suburban anthroscape	SAT
		urban anthroscape	UAT

**E) ANTHROPOGENIC LANDFORMS** [discrete, human-made or modified, earth-surface features].

artificial collapsed depression	ACD	landfill ( <i>see sanitary landfill</i> )	--
artificial levee ( <i>also Anthro LF</i> )	AL	leveled land	LVL
bioswale ( <i>also Anthro Micro</i> )	BS	midden ( <i>also Anthro Micro</i> )	MI
borrow pit	BP	openpit mine	OM
burial mound ( <i>also Anthro Micro</i> )	BM	polder	POL
conservation terrace ( <i>modern</i> )	CT	quarry	QU
cut ( <i>e.g. railroad</i> )	CUT	railroad bed	RRB
cutbank	CB	reclaimed land	RL
dredge spoil bank	DSB	rice paddy ( <i>also Anthro Micro</i> )	RP
dredge-deposit shoal	DDS	road bed	RB
dredged channel ( <i>also Anthro Micro</i> )	DC	sand pit	SP
dump	DU	sanitary landfill	SL
fill	FI	scalped area ( <i>also Anthro Micro</i> )	SA
filled marshland ( <i>also Anthro Micro</i> )	FM	sewage lagoon	SWL
		spoil bank ( <i>also Anthro Micro</i> )	SB
floodway	FW	spoil pile ( <i>also Anthro Micro</i> )	SPP
gravel pit ( <i>also Anthro Micro</i> )	GP	surface mine	SM
headwall ( <i>anthro</i> ) ( <i>also Anthro Micro</i> )	HW	truncated soil ( <i>also Anthro Micro</i> )	TS
hillslope terrace ( <i>e.g., ancient</i> )	HT		

**F) ANTHROPOGENIC MICROFEATURES** [discrete, human-made or modified, earth-surface features].

artificial levee	AL	headwall [ <i>anthro</i> ] ( <i>also Anth LF</i> )	HW
beveled cut	BC	hillslope terrace ( <i>ancient</i> )	HT
bioswale ( <i>also Anthro LF</i> )	BS	impact crater	IC
borrow pit	BP	interfurrow	IF
burial mound ( <i>also Anthro LF</i> )	BM	log landing	LL
conservation terrace ( <i>modern</i> )	CT	midden ( <i>also Anthro LF</i> )	MI
cut ( <i>railroad, etc.</i> )	CUT	pond ( <i>human-made</i> )	PO
cutbank	CB	railroad bed	RRB
ditch	DI	reclaimed land	RL
double-bedding mound	DBM	rice paddy ( <i>also Anthro LF</i> )	RP
( <i>i.e. bedding mound for timber;</i>		road bed	RB
<i>Lower Coastal Plain</i> )		road cut	RC
drainage ditch	DD	sand pit	SP
dredged channel ( <i>also Anthro LF</i> )	DC	scalped area ( <i>also Anthro LF</i> )	SA
fill	FI	sewage lagoon	SWL
filled marshland ( <i>also Anth LF</i> )	FM	skid trail	ST
floodway	FW	spoil bank ( <i>also Anthro LF</i> )	SB
furrow	FR	spoil pile ( <i>also Anthro LF</i> )	SPP
gravel pit ( <i>also Anthro LF</i> )	GP	tillage mound	TM
		truncated soil ( <i>also Anthro LF</i> )	TS



**II - GEOMORPHIC PROCESS GROUPS** [Landscape, Landform, and Microfeature terms by geomorphic process (e.g. Fluvial) or by other common settings (e.g. Water Bodies). These lists are not mutually exclusive, so some features occur in more than one group, particularly generic terms.)

**1. COASTAL MARINE and ESTUARINE** (wave or tidal control, or near-shore / shallow marine).

**Landscapes:**

barrier island ( <i>also Landform</i> )	BI	lowland	LW
bay [coast] ( <i>water body; also Landform</i> )	BY	marine terrace ( <i>also Landform</i> )	MT
coastal plain ( <i>also Landform</i> )	CP	ocean ( <i>water body; also Landform</i> )	OC
delta plain ( <i>also Landform</i> )	DP	peninsula	PE
estuary ( <i>water body; also Landform</i> )	ES	sea ( <i>water body; also Landform</i> )	SEA
fluviomarine terrace ( <i>also Landform</i> )	FT	shore complex	SX
gulf ( <i>water body; also Landform</i> )	GU	sound ( <i>water body; also Landform</i> )	SO
island ( <i>also Landform</i> )	IS	strait ( <i>water body; also Landform</i> )	ST
lagoon ( <i>water body; also Landform</i> )	LG		

**Landforms:**

Atoll	AT	lagoon ( <i>water body; also Landscape</i> )	WI
back-barrier beach	BBB	lagoon [relict]	LAR
back-barrier flat	BBF	longshore bar	LON
backshore	AZ	longshore bar [relict]	LR
bar	BR	mangrove swamp	MAN
barrier beach	BB	marine lake ( <i>water body</i> )	ML
barrier cove	BAC	marine terrace ( <i>also Landscape</i> )	MT
barrier flat	BF	nearshore zone	NZ
barrier island ( <i>also Landscape</i> )	BI	nearshore zone [relict]	NZR
bay [coast] ( <i>water body; also LS</i> )	BAY	point bar [coastal]	PRC
bay bottom	BOT	raised beach	RA
beach	BE	reef	RF
beach plain	BP	sabkha	SAB
beach ridge	BG	salt marsh	SM
beach terrace	BT	sea ( <i>water body; also Landscape</i> )	SEA
berm	BM	sea cliff	RZ
bluff	BN	semi-open depression	SOD
chenier	CG	shoal (relict)	SE
chenier plain	CH	shore	SHO
coastal plain ( <i>also Landscape</i> )	CP	shore complex ( <i>also Landscape</i> )	SHC
coral island	COR	sound ( <i>water body; also Landscape</i> )	SO
cove [water]	COW	spit	SP
delta	DE	stack [coast]	SRC
delta plain ( <i>also Landscape</i> )	DC	strait ( <i>water body; also Landscape</i> )	STT
drainhead complex	DRC	strand plain	SS
<b>estuarine tidal stream (<i>also Micro</i>)</b> <b>ETS</b>		submerged-upland tidal marsh	STM
estuary ( <i>also Landscape</i> )	WD	tidal flat	TF
flat	FL	tidal inlet	TI
flatwoods	FLW	tidal inlet [relict]	TIR
fluviomarine terrace ( <i>also Landscape</i> )	FMT	tidal marsh	TM
foredune	FD	tombolo	TO
fringe-tidal marsh	FTM	washover fan	WF
gulf ( <i>water body; also Landscape</i> )	GU	wave-built terrace	WT
gut [channel] ( <i>water body; also Micro</i> )	WH	wave-cut platform	WP
headland	HE	wind-tidal flat	WTF
island ( <i>also Landscape</i> )	IS		

**Microfeatures:**

<b>estuarine tidal stream</b> (also <i>LF</i> )	<b>ETS</b>	shoreline	SH
gut [channel] (water body; Landform)	WH	swash zone	SZ
ripple mark	RM		

**2. LACUSTRINE** (related to inland water bodies).

bay [coast] (also Landform)	BY	lake plain (also Landform)	LP
delta plain (also Landform)	DP	peninsula	PE
island (also Landform)	IS	shore complex (also Landform)	SX

**Landforms:**

backshore	AZ	longshore bar	LON
bar (also Microfeature)	BR	longshore bar [relict]	LR
barrier beach	BB	nearshore zone	NZ
barrier flat	BF	nearshore zone [relict]	NZR
barrier island	BI	oxbow lake	WK
bay [coast] (also Landscape)	BAY	playa	PL
beach	BE	playa floor (also Microfeature)	PFL
beach plain	BP	playa lake (water body)	WL
beach ridge	BG	playa rim (also Microfeature)	PRI
beach terrace	BT	playa slope (also Microfeature)	PSL
berm	BM	playa step (also Microfeature)	PST
bluff	BN	pluvial lake	PLL
delta	DE	pluvial lake (relict)	PQ
delta plain (also Landscape)	DC	raised beach	RA
flat	FL	sabkha	SAB
flood-plain playa	FY	salt marsh	SM
foredune	FD	shoal (relict)	SE
headland	HE	shore	SHO
island (also Landscape)	IS	shore complex (also Landscape)	SHC
karst lake	KAL	spit	SP
lagoon	WI	stack [coast]	SRC
lagoon [relict]	LAR	strand plain	SS
lake (water body)	WJ	till-floored lake plain	TLP
lake plain (also Landscape)	LP	tombolo	TO
lake terrace	LT	water-lain moraine	WM
lakebed [relict]	LBR	wave-built terrace	WT
lakeshore	LF	wave-cut platform	WP
		wave-worked till plain	WW

**Microfeatures:**

bar (also Landform)	BA	ripple mark	RM
playa floor (also Landform)	PF	shoreline	SH
playa rim (also Landform)	PR	strandline	SL
playa slope (also Landform)	PSL	swash zone	SZ
playa step (also Landform)	PST	vernal pool	VP
playette	PL		



- 3. FLUVIAL** [dominantly related to concentrated water flow (channel flow); includes erosional and depositional features, but excludes glaciofluvial landforms (see Glacial), and permanent water features (e.g. *river*; see Water Bodies)].

**Landscapes:**

alluvial plain	AP	delta plain ( <i>also Landform</i> )	DP
alluvial plain remnant	AR	dissected breaklands	DB
badlands	BA	fan piedmont	FP
bajada ( <i>also Landform</i> )	BJ	meander belt	MB
breaklands	BR	river valley	RV
breaks	BK	scabland	SC
canyonlands	CL		

**Landforms:**

alluvial cone	AC	flood-plain splay	FM
alluvial fan	AF	flood-plain step	FO
alluvial flat	AP	giant ripple	GC
arroyo	AY	gorge	GO
axial stream ( <i>water body</i> )	AX	gulch	GT
backswamp	BS	gut [valley]	GV
bajada ( <i>also Landform</i> )	BJ	inset fan	IF
bar ( <i>also Microfeature</i> )	BR	intermittent stream ( <i>also Microfeature</i> )	INT
basin-floor remnant	BD	levee	LV
block stream	BX	meander scar	MS
box canyon	BOX	meander scroll	MG
braided stream	BZ	meandering channel	MC
canyon	CA	natural levee	NL
channel	CC	overflow stream channel	OSC
coulee	CE	oxbow	OX
cutoff	CV	paleoterrace	PTR
delta	DE	point bar	PR
delta plain ( <i>also Landscape</i> )	DC	ravine	RV
drainageway	DQ	river valley ( <i>also Landscape</i> )	RVV
drainhead complex	DRC	semi-open depression	SOD
draw	DW	slot canyon	SLC
ephemeral stream ( <i>also Microfeature</i> )	EPS	strath terrace	SU
fan apron	FA	stream terrace	SX
fan collar	FCO	terrace remnant	TR
fan remnant	FH	valley flat	VF
fan skirt	FI	valley border surfaces	VBS
fanhead trench	FF	valley floor remnant	VFR
flood plain	FP	wash	WA
flood-plain playa	FY	wind gap	WG

**Microfeatures:**

bar ( <i>also Landform</i> )	BA	gully	GU
bar & channel ( <i>patterned ground</i> )	BC	intermittent stream ( <i>also Landform</i> )	INT
channel	CH	ripple mark	RM
ephemeral stream ( <i>also Landform</i> )	ES	swash zone	SZ
groove	GR		

**4. SOLUTION** (dominated by dissolution, and commonly, subsurface drainage).**Landscapes:**

cockpit karst	CPK	kegel karst	KK
cone karst	CK	sinkhole karst	SK
fluviokarst	FK	thermokarst	TK
glaciokarst	GK	tower karst	TW
karst	KP		

**Landforms:**

blind valley	VB	pavement karst	PAV
cockpit	COC	pinnacle	PIN
collapse sinkhole	CSH	sinkhole	SH
interior valley	INV	solution platform	SOP
karst cone	KC	solution sinkhole	SOS
karst lake ( <i>water body</i> )	KAL	swallow hole	TB
karst tower	KTO	thermokarst depression	TK
karst valley	KVA	( <i>also Microfeature</i> )	
karstic marine terrace	KMT	yardang ( <i>also Microfeature</i> )	YD
mogote	MOG	yardang trough ( <i>also Microfeature</i> )	YDT

**Microfeatures:**

cutter	CU	solution pipe	SOP
karren	KA	thermokarst depression ( <i>also Landform</i> )	TK
solution chimney	SCH	yardang ( <i>also Landform</i> )	YD
solution corridor	SCO	yardang trough ( <i>also Landform</i> )	YDT
solution fissure	SOF		

**5. EOLIAN** (dominantly wind related, erosional or depositional).**Landscapes:**

<b>coppice dune field</b>	<i>CDF</i>	sand plain	<i>SP</i>
dune field ( <i>also Landscape</i> )	<i>DU</i>	sandhills	<i>SH</i>

**Landforms:**

barchan dune	<i>BQ</i>	paha	<i>PA</i>
blowout	<i>BY</i>	parabolic dune	<i>PB</i>
climbing dune	<i>CDU</i>	parna dune	<i>PD</i>
deflation basin	<i>DB</i>	playa dune ( <i>also Microfeature</i> )	<i>PDU</i>
dune	<i>DU</i>	sabkha	<i>SAB</i>
dune field ( <i>also Landscape</i> )	<i>DUF</i>	sand ramp	<i>SAR</i>
dune lake ( <i>water body</i> )	<i>DUL</i>	sand sheet	<i>RX</i>
dune slack ( <i>also Microfeature</i> )	<i>DUS</i>	seif dune	<i>SD</i>
falling dune	<i>FDU</i>	slickrock ( <i>also Microfeature</i> )	<i>SLK</i>
foredune	<i>FD</i>	star dune	<i>SDU</i>
interdune ( <i>also Microfeature</i> )	<i>ID</i>	transverse dune	<i>TD</i>
loess bluff	<i>LO</i>	yardang ( <i>also Microfeature</i> )	<i>YD</i>
loess hill	<i>LQ</i>	yardang trough ( <i>also Microfeature</i> )	<i>YDT</i>
longitudinal dune	<i>LDU</i>		

**Microfeatures:**

dune slack ( <i>also Landform</i> )	<i>DS</i>	slickrock ( <i>also Landform</i> )	<i>SLK</i>
dune traces	<i>DT</i>	slip face	<i>SF</i>
interdune ( <i>also Landform</i> )	<i>ID</i>	yardang ( <i>also Landform</i> )	<i>YD</i>
playa dune ( <i>also Landform</i> )	<i>PD</i>	yardang trough ( <i>also Landform</i> )	<i>YDT</i>
playette	<i>PL</i>	zibar	<i>ZB</i>
shrub-coppice dune	<i>SCD</i>		

**6.GLACIAL** (directly related to glaciers; includes ice-contact, glaciofluvial, glaciolacustrine, glaciomarine, and outwash features)**Landscapes:**

continental glacier	CG	ice-margin complex	IC
drumlin field	DF	outwash plain ( <i>also Landform</i> )	OP
glaciokarst	GK	till plain ( <i>also Landform</i> )	TP
hills	HI		

**Landforms:**

alpine glacier	AG	kame	KA
arete	AR	kame moraine	KM
cirque	CQ	kame terrace	KT
cirque floor	CFL	kettle	KE
cirque headwall	CHW	lateral moraine	LM
cirque platform	CPF	medial moraine	MH
col	CL	moraine	MU
collapsed ice-floored lakebed	CK	nunatak	NU
collapsed ice-walled lakebed	CN	outwash delta	OD
collapsed lake plain	CS	outwash fan	OF
collapsed outwash plain	CT	outwash plain ( <i>also Landscape</i> )	OP
crag and tail	CAT	outwash terrace	OT
crevasse filling	CF	paha	PA
disintegration moraine	DM	pitted outwash plain	PM
drumlin	DR	pitted outwash terrace	POT
drumlinoid ridge	DRR	pothole ( <i>also Microfeature</i> )	PH
end moraine	EM	pothole lake ( <i>intermittent water</i> )	WN
esker	EK	proglacial lake ( <i>water body</i> )	WO
fjord ( <i>water body</i> )	FJ	proglacial lake [relict]	PGL
flute ( <i>also Microfeature</i> )	FU	recessional moraine	RM
fosse	FV	roche moutonnée ( <i>also Microfeature</i> )	RN
giant ripple	GC	rock glacier	RO
glacial drainage channel	GD	snowfield	SNF
glacial lake ( <i>water body</i> )	WE	stoss and lee	SAL
glacial lake [relict]	GL	tarn ( <i>water body; also Microfeature</i> )	TAR
glacial-valley floor	GVF	terminal moraine	TA
glacial-valley wall	GVW	till plain ( <i>also Landscape</i> )	TP
glacier	GLA	till-floored lake plain	TLP
ground moraine	GM	tunnel valley	TV
hanging valley	HV	tunnel-valley lake ( <i>water body</i> )	TVL
head-of-outwash	HD	U - shaped valley	UV
ice pressure ridge	IPR	underfit stream	US
ice-contact slope	ICS	valley train	VT
ice-marginal stream	IMS	water-lain moraine	WM
ice-pushed ridge	IPU	wave-worked till plain	WW
interdrumlin	IDR		

**Microfeatures:**

flute ( <i>also Landform</i> )	FL	pothole ( <i>also Landform</i> )	PH
glacial groove	GG	roche moutonnée ( <i>also Landform</i> )	POC
ice wedge	IW	swale ( <i>also Landform</i> )	SW
ice wedge cast	IWC	tarn ( <i>water body; also Landform</i> )	TN
nivation hollow	NH		

**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	HI	thermokarst	TK

**Landforms:**

alas	AA	pingo	PI
block field	BW	rock glacier	RO
muskeg	MX	string bog	SY
patterned ground	PG	thermokarst depression	TK
(see Microfeatures for types)		(also Microfeature)	
peat plateau	PJ	thermokarst lake (water body)	WV

**Microfeatures:**

circle	CI	palsa (= peat hummocks)	PA
earth hummock	EH	polygon	PYG
frost boil	FB	solifluction lobe	SOL
high-center polygon	HCP	solifluction sheet	SS
ice wedge	IWD	solifluction terrace	ST
ice wedge cast	IWC	sorted circle	SCI
ice wedge polygon	IWP	stripe	STR
low-center polygon	LCP	thermokarst depression	TK
nivation hollow	NH	(also Landform)	
nonsorted circle	NSC	turf hummock	TH

## 8. MASS MOVEMENT (MASS WASTING) (dominated by gravity, including creep forms; also see Mass Movement Types table).

**Landscapes:** (These generic Landscapes are not Mass Movement features per say, but are commonly modified by, and include localized areas of, Mass Movement).

breaklands	<i>BR</i>	hills	<i>HI</i>
dissected breaklands	<i>DB</i>	mountain range	<i>MR</i>
foothills	<i>FH</i>	mountains	<i>MO</i>

### Landforms:

ash flow	<i>AS</i>	rock topple	<i>ROT</i>
avalanche chute	<i>AL</i>	rockfall ( <i>also Microfeature</i> )	<i>ROF</i>
block glide	<i>BLG</i>	rockfall avalanche	<i>RFA</i>
block stream	<i>BX</i>	rotational debris slide	<i>RDS</i>
colluvial apron	<i>COA</i>	rotational earth slide	<i>RES</i>
complex landslide	<i>CLS</i>	rotational rock slide	<i>RRS</i>
creep	<i>CRE</i>	rotational slide	<i>RTS</i>
debris avalanche	<i>DA</i>	sag ( <i>also Microfeature</i> )	<i>SAG</i>
debris fall	<i>DEF</i>	sag pond	<i>SGP</i>
debris flow	<i>DF</i>	( <i>water body; also Microfeature</i> )	
debris slide	<i>DS</i>	sand flow	<i>RW</i>
debris spread	<i>DES</i>	scree slope	<i>SCS</i>
debris topple	<i>DET</i>	slide	<i>SJ</i>
earth flow	<i>EF</i>	slump block	<i>SN</i>
earth spread	<i>ESP</i>	soil fall	<i>SOF</i>
earth topple	<i>ETO</i>	talus cone	<i>TC</i>
fall	<i>FB</i>	talus slope	<i>TAS</i>
flow	<i>FLO</i>	toe [mass movement]	<i>TOE</i>
lahar	<i>LA</i>	( <i>also Microfeature</i> )	
landslide	<i>LK</i>	topple	<i>TOP</i>
lateral spread	<i>LS</i>	Toreva block	<i>TOR</i>
main scarp ( <i>also Microfeature</i> )	<i>MAS</i>	translational debris slide	<i>TDS</i>
mudflow	<i>MW</i>	translational earth slide	<i>TES</i>
rock glacier	<i>RO</i>	translational rock slide	<i>TRS</i>
rock spread	<i>ROS</i>	translational slide	<i>TS</i>

### Microfeatures:

main scarp ( <i>also Landform</i> )	<i>MAS</i>	solifluction lobe	<i>SOL</i>
minor scarp	<i>MIS</i>	solifluction sheet	<i>SS</i>
rockfall ( <i>also Landform</i> )	<i>ROF</i>	solifluction terrace	<i>ST</i>
sag ( <i>also Landform</i> )	<i>SAG</i>	terraces	<i>TER</i>
sag pond ( <i>also Landform</i> )	<i>SP</i>	toe [mass movement]	<i>TOE</i>
sand boil	<i>SB</i>	( <i>also Landform</i> )	

**9. VOLCANIC and HYDROTHERMAL****Landscapes:**

caldera (also Landform)	CD	lava plateau (also Landform)	LL
foothills	FH	mountains	MO
hills	HI	shield volcano (also Landform)	SV
lava field (also Landform)	LF	volcanic field (also Landform)	VF
lava plain (also Landform)	LV		

**Landforms:**

<b>aa</b> lava flow	ALF	lava plateau (also Landscape)	LL
ash field	AQ	lava trench (also Microfeature)	LTR
ash flow	AS	lava tube	LTU
block lava flow	BLF	louderback	LU
caldera (also Landscape)	CD	maar	MAA
cinder cone	CI	mawae	MAW
diatreme	DT	mud pot	MP
dike	DK	pahoehoe lava flow	PAF
fissure vent	FIV	pillow lava flow	PIF
geyser	GE	plug dome	PP
geyser basin	GEB	pyroclastic flow	PCF
geyser cone	GEC	pyroclastic surge	PCS
hot spring	HP	shield volcano (also Landform)	SHV
kipuka	KIP	steptoe	ST
lahar	LA	stratovolcano	SV
lava dome	LD	volcanic cone	VC
lava field (also Landscape)	LFI	volcanic crater	CR
lava flow	LC	volcanic dome	VD
lava flow-unit (also Microfeature)	LFU	volcanic field (also Landscape)	VOF
lava plain (also Landscape)	LN	volcanic neck	VON
		volcanic pressure ridge (also Microfeature)	PU

**Microfeatures:**

corda	CO	spiracle	SPI
lava flow unit (also Landform)	LFU	tumulus (tumuli = plural)	TU
lava trench (also Landform)	LT	volcanic pressure ridge (also Landform)	VPR
spatter cone	SPC		

**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:***

basin floor	<i>BC</i>	mountain range	<i>MR</i>
batholiths	<i>BL</i>	mountain system	<i>MS</i>
bolson	<i>BO</i>	mountains	<i>MO</i>
breached anticline ( <i>also Landform</i> )	<i>BD</i>	plateau	<i>PT</i>
fault-block mountains	<i>FM</i>	rift valley	<i>RF</i>
fold-thrust hills	<i>FTH</i>	semi-bolson	<i>SB</i>
foothills	<i>FH</i>	tableland	<i>TB</i>
hills	<i>HI</i>	valley	<i>VA</i>
intermontane basin	<i>IB</i>		

***Landforms:***

anticline	<i>AN</i>	hogback	<i>HO</i>
breached anticline ( <i>also Landscape</i> )	<i>BRL</i>	homoclinal ridge	<i>HCR</i>
canyon bench	<i>CYB</i>	horst	<i>HT</i>
cuesta	<i>CU</i>	louderback	<i>LU</i>
cuesta valley	<i>CUV</i>	meteorite crater	<i>MEC</i>
diapir	<i>DD</i>	monocline	<i>MJ</i>
dike	<i>DK</i>	rock pediment	<i>ROP</i>
dip slope	<i>DL</i>	scarp slope	<i>RS</i>
dome	<i>DO</i>	sill	<i>RT</i>
fault-block	<i>FAB</i>	stock	<i>STK</i>
fault-line scarp	<i>FK</i>	strike valley	<i>STV</i>
fault zone	<i>FAZ</i>	structural bench	<i>SB</i>
fold	<i>FQ</i>	syncline	<i>SZ</i>
graben	<i>GR</i>	window	<i>WIN</i>
half graben	<i>HG</i>		

***Microfeatures:***

sand boil	<i>SB</i>
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**11. SLOPE** (Generic terms (e.g. hill) or those that describe slope form, geometry, or arrangement of land features, rather than any particular genesis or process).

**Landscapes:**

badlands	BA	mountain range	MR
breached anticline ( <i>also Landform</i> )	BD	mountain system	MS
breaklands	BR	mountains	MO
breaks	BK	piedmont	PI
canyonlands	CL	piedmont slope	PS
dissected breaklands	DB	plains ( <i>plural = Landform</i> )	PL
dissected plateau	DI	plateau ( <i>also Landscape</i> )	PT
foothills	FH	tableland	TB
hills	HI	upland	UP

**Landforms:**

beveled base	BVB	low hill	LH
block stream	BX	mesa	ME
bluff	BN	mountain ( <i>plural = Landscape</i> )	MM
breached anticline ( <i>also Landscape</i> )	BRL	mountain slope	MN
broad interstream divide	BID	mountain valley	MV
butte	BU	notch	NO
canyon bench	CYB	paha	PA
cliff	CJ	peak	PK
colluvial apron	COA	pediment	PE
cuesta	CU	plain ( <i>plural = Landscape</i> )	PN
dip slope	DL	plateau ( <i>also Landscape</i> )	PT
dome	DO	ridge	RI
escarpment	ES	rim	RJ
faceted spur	FS	rise ( <i>also Microfeature</i> )	RIS
fault block	FAB	rock pediment	ROP
fault-line scarp	FK	scarp	RY
free face	FW	scarp slope	RS
( <i>also Geom. Comp. – Hills, Mountain</i> )		scree slope	SCS
gap	GA	slickrock ( <i>also Microfeature</i> )	SLK
headwall	HW	spur	SQ
high hill	HH	stack [geom]	SR
hill ( <i>plural = Landscape</i> )	HI	structural bench	SB
hillslope	HS	talus cone	TC
hogback	HO	talus slope	TAS
interfluve ( <i>also Geom. Comp. – Hills</i> )	IV	tor	TQ
knob	KN	valley	VA
knoll	KL	valley floor remnant	VFR
ledge	LE	wind gap	WG

**Microfeatures:**

finger ridge	FR	rise ( <i>also Landform ;</i>	RIS
mound	MO	( <i>also Geom. Comp – Flat Plains</i> )	
rib	RB	slickrock ( <i>also Landform</i> )	SL
rill	RL		

**12. EROSIONAL** [Related dominantly to water erosion but excludes perennial, concentrated channel flow (i.e. fluvial, glaciofluvial), or eolian erosion].

***Landscapes:***

badlands	BA	hills	HI
breached anticline ( <i>also Landform</i> )	BD	mountain range	MR
breaklands	BR	mountains	MO
breaks	BK	piedmont	PI
canyonlands	CL	piedmont slope	PS
dissected breaklands	DB	plateau ( <i>also Landscape</i> )	PT
dissected plateau	DI	tableland	TB
foothills	FH		

***Landforms:***

ballena	BL	paha	PA
ballon	BV	partial ballena	PF
basin floor remnant	BD	peak	PK
beveled base	BVB	pediment	PE
breached anticline ( <i>also Landscape</i> )	BRL	plateau ( <i>also Landscape</i> )	PT
canyon bench	CYB	rock pediment	ROP
col	CL	sabkha	SAB
colluvial apron	COA	saddle	SA
cuesta	CU	scarp slope	RS
cuesta valley	CUV	slickrock ( <i>also Microfeature</i> )	SLK
eroded fan remnant	EFR	stack [geom]	SR
eroded fan-remnant sideslope	EFS	strike valley	STV
erosion remnant	ER	structural bench	SB
free face ( <i>also Geom. Comp.–Hills,Mount.</i> )	FW	terrace remnant	TER
gap	GA	tor	TQ
hogback	HO	valley border surfaces	VBS
inselberg	IN	valley floor remnant	VFR
monadnock	MD	wind gap	WG
notch	NO	window	WIN

***Microfeatures:***

earth pillar	EP	pinnacle	PI
finger ridge	FR	rib	RB
groove	GR	rill	RL
gully	GU	slickrock ( <i>also Landform</i> )	SLK
hoodoo	HO	swale	SW

**13. DEPRESSIONAL** ( Low areas or declivity features, excluding permanent water bodies ).**Landscapes:**

basin	BS	dissected breaklands	DB
basin floor ( <i>also Landform</i> )	BC	semi-bolson	SB
bolson	BO	valley	VA
breached anticline ( <i>also Landform</i> )	BD		
breaklands	BR		

**Landforms:**

alluvial flat	AP	open depression ( <i>also Microfeature</i> )	ODE
basin floor ( <i>also Landscape</i> )	BC	playa	PL
basin floor remnant	BD	playa floor ( <i>also Microfeature</i> )	PFL
box canyon	BOX	playa rim ( <i>also Microfeature</i> )	PRI
breached anticline ( <i>also Landform</i> )	BRL	playa slope ( <i>also Microfeature</i> )	PSL
canyon	CA	playa step ( <i>also Microfeature</i> )	PST
canyon wall	CW	pothole ( <i>also Microfeature</i> )	PH
closed depression ( <i>also Microfeature</i> )	CLD	pothole ( <i>intermittent water</i> )	WN
col	CL	ravine	RV
coulee	CE	sabkha	SAB
cove	CO	saddle	SA
cuesta valley	CUV	sag ( <i>also Microfeature</i> )	SAG
depression	DP	semi-open depression	SOD
drainageway	DQ	slot canyon	SLC
drainhead complex	DRC	strike valley	STV
gap	GA	swale ( <i>also Microfeature</i> )	SC
gorge	GO	trough	TR
gulch	GT	U-shaped valley	UV
gut [valley]	GV	valley	VA
intermontane basin	IB	valley floor	VL
kettle	KE	V-shaped valley	VV
mountain valley	MV		

**Microfeatures:**

closed depression ( <i>also Landform</i> )	CD	playa step ( <i>also Landform</i> )	PST
open depression ( <i>also Landform</i> )	OP	pothole ( <i>also Landform</i> )	PH
playa floor ( <i>also Landform</i> )	PF	sag ( <i>also Landform</i> )	SAG
playa rim ( <i>also Landform</i> )	PR	swale ( <i>also Landform</i> )	SW
playa slope ( <i>also Landform</i> )	PSL	tree-tip pit	TTP

**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 ( <i>also Landform</i> )	ES
everglades	EG

[ 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	muskeg	MX
backswamp	BS	oxbow lake ( <i>ephemeral water</i> )	WK
bog	BO	peat plateau	PJ
Carolina Bay	CB	playa ( <i>intermittent water</i> )	PL
dune slack ( <i>also Microfeature</i> )	DUS	pocosin	PO
ephemeral stream ( <i>also Microfeature</i> )	EPS	pothole ( <i>also Microfeature</i> )	PH
<b>estuarine tidal stream (<i>also Micro</i>)</b>	<b>ETS</b>	pothole lake ( <i>intermittent water</i> )	WN
estuary ( <i>also Landscape</i> )	WD	raised bog	RB
fen	FN	ribbed fen	RG
flood-plain playa	FY	sabkha	SAB
fringe tidal marsh	FTM	salt marsh	SM
highmoor bog	HB	slough ( <i>intermittent water</i> )	SL
intermittent stream ( <i>also Microfeature</i> )	INT	string bog	SY
lowmoor bog	LX	swamp	SW
mangrove swamp	MAN	tidal flat	TF
marsh	MA	tidal marsh	TM

**Microfeatures:**

dune slack ( <i>also Landform</i> )	DS	playette	PL
ephemeral stream ( <i>also Landform</i> )	ES	pothole ( <i>intermittent water; also Landform</i> )	PH
<b>estuarine tidal stream (<i>also LF</i>)</b>	<b>ETS</b>	vernal pool ( <i>seasonal water</i> )	VP
intermittent stream ( <i>also Landform</i> )	INT		

**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] ( <i>also Landform</i> )	BY	ocean	OC
estuary ( <i>also Landform</i> )	ES	sea ( <i>also Landform</i> )	SEA
gulf ( <i>also Landscape</i> )	GU	sound ( <i>also Landform</i> )	SO
lagoon ( <i>also Landform</i> )	LG	strait ( <i>also Landform</i> )	ST

**Landforms:**

axial stream	AX	playa lake	WL
bay [coast]; ( <i>also Landscape</i> )	BAY	pluvial lake	PLL
bayou	WC	pothole lake ( <i>also Microfeature</i> )	WN
cove ( <i>water body</i> )	COW	proglacial lake	WO
dune lake	DUL	river	RIV
<b>estuarine tidal stream (<i>also Micro</i>) ETS</b>		sag pond ( <i>also Microfeature</i> )	SGP
estuary ( <i>also Landscape</i> )	WD	salt pond ( <i>also Microfeature</i> )	WQ
fjord	FJ	sea ( <i>also Landscape</i> )	SEA
glacial lake	WE	shoal	WR
gulf ( <i>also Landscape</i> )	GU	slackwater	WS
gut [channel] ( <i>also Microfeature</i> )	WH	slough	SL
ice-marginal stream	IMS	sound ( <i>also Landscape</i> )	SO
inlet	IL	strait ( <i>also Landscape</i> )	STT
lagoon ( <i>also Landscape</i> )	WI	stream ( <i>permanent water</i> )	STR
lagoon channel	LCH	tarn ( <i>also Microfeature</i> )	TAR
lake	WJ	thermokarst lake	WV
lakebed	LB	tidal inlet	TI
marine lake ( <i>water body</i> )	ML	tidal inlet [relict]	TIR
nearshore zone	NZ	tunnel-valley lake	TVL
oxbow lake	WK		
perennial stream ( <i>also Microfeature</i> ) PS			

**Microfeatures:**

channel ( <i>permanent water</i> )	CH	pool	POO
<b>estuarine tidal stream (<i>also LF</i>) ETS</b>		sag pond ( <i>also Landform</i> )	SP
gut [channel] ( <i>also Landform</i> )	WH	salt pond ( <i>also Landform</i> )	WQ
perennial stream ( <i>also Landform</i> )	PS	tank	TA
pond	PON	tarn ( <i>also Landform</i> )	TN

**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] ( <i>water body; also Landform</i> )	BY	sea ( <i>water body; also Landform</i> )	SEA
estuary ( <i>water body; also Landform</i> )	ES	sound ( <i>water body; also Landform</i> )	SO
gulf ( <i>water body; also Landform</i> )	GU	strait ( <i>water body; also Landform</i> )	ST
lagoon ( <i>water body; also Landform</i> )	LA		
ocean ( <i>water body</i> )	OC		

**Landforms:**

barrier cove	BAC	mainland cove	MAC
bay [coast] ( <i>water body; also Landscape</i> )	BAY	marine lake	ML
bay bottom	BOT	nearshore zone	NZ
cove [water]	CO	reef	RF
estuary ( <i>water body; also Landscape</i> )	WD	sea ( <i>water body; also Landform</i> )	SEA
flood-tidal delta	FTD	shoal	WR
flood-tidal delta flat	FTF	sound ( <i>water body; also Landform</i> )	SO
flood-tidal delta slope	FTS	strait ( <i>water body; also Landform</i> )	STT
fluviomarine bottom	FMB	submerged back-barrier beach	SBB
gulf ( <i>water body; also Landscape</i> )	GU	submerged mainland beach	SMB
inlet	IL	submerged point bar [coastal]	SPB
lagoon ( <i>water body; also Landscape</i> )	WI	submerged wave-built terrace	SWT
lagoon bottom	LBO	submerged wave-cut platform	SWP
lagoon channel	LCH	tidal inlet	TI
lake	WJ	tidal inlet [relict] ( <i>water body</i> )	TIR
lakebed	LB	washover-fan flat	WFF
longshore bar	LON	washover-fan slope	WFS

**Microfeatures:**

channel ( <i>permanent water</i> )	CH
gut ( <i>channel; water body; also Landform</i> )	WH

**Anthropogenic Feature:**

dredge-deposit shoal	DDS
dredged channel	DC

**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)

aa lava	cryoturbate
ablation till	cyclothem
alluvium	dead-ice - NR
andesitic lahar	debris
anticline	debris avalanche deposit
aquiclude	debris flow deposit
aquifer	debris slide deposit
aquitard	deposit
artifact	desert pavement
ash	desert varnish - NP
ash flow	detritus (geology)
backswamp deposit	diamictite
basal till	diamicton
bauxite	diatomaceous earth
beach sands	diatomite
bed	dike
bedded	dip
bedding plane	discontinuity
bedrock	discontinuous permafrost
block	dropstone
block lava	dolomite (mineral)
block field	dolomite (rock)
block glide deposit	dolostone - NR
block stream	dome
blue rock [volcanic]	dredge spoils
bombs [volcanic]	drift (glacial geology)
boulder field - NR	earthflow deposit
bowl	eolian deposit
breccia	epiclastic
buried soil	erosional pavement
caliche	erratic
caprock	estuarine deposit
chert	facies (stratigraphy)
chimney	fanglomerate
cinders	felsenmeer - NP
clast	felsic rock
clastic	fill
coastal marl	fly ash
colluvium	flowtill
complex landslide deposit	fluviomarine deposit
conglomerate	fold
continuous permafrost	formation (stratigraphy)
coprogenous earth	freshwater marl
coprogenous material	glacial drift - NR
coral limestone	glacial outwash - NR
country rock	glacial till - NR
craton	glaciofluvial deposits
creep deposit	glaciolacustrine deposits
cross-bedding	glaciomarine deposits
cross-lamination	glauconite pellets
cross-stratification	graben
cryptogamic crust	granitoid

ground soil	pitted outwash
grus	plow pan
gypsite	pluton
herbaceous peat	plutonic
human-transported material	porcellanite
horst	puff
ice-pushed ridge	pumice
ice wedge	pyroclastic
ice wedge cast	regolith
igneous rock	relict soil
interbedded	residuum
intrusive	rhythmite
lacustrine deposit	rockfall deposit
lagoonal deposit	rockfall avalanche deposit
lahar deposit	rockfall landslide deposit
lamella	rock varnish
lamina	rotational landslide deposit
lamination - NR	rubble
lapilli	sand sheet
lateral spread deposit	sandstone
lava	saprolite
limestone	scoria
limonite	scree
lithologic	sediment
lodgment till	sedimentary peat
loess	sedimentary rock
louderback	shale
mafic rock	siltstone
marine deposit	sill
marl	siltite
melt-out till	slide
metamorphic rock	slip face
metasediment	slip surface
microbiotic crust	slope alluvium
mine spoil, coal extraction	sloughed till - NR
mine spoil, metal-ore extraction	slump - NR
mine spoil or earthy fill	slump block
moraine	slump till
moss peat	soil fall deposit
muck	solifluction deposit
mucky peat	solifluction sheet
mudstone	spoil bank
mudflow deposit	spoil pile
novaculite	sporadic permafrost
nueé ardente	stagnant ice
outcrop	stone line
outwash	strandline
overbank deposit	subglacial till
overburden	subglacial melt-out till
overthrust	supraglacial till
paleosol	supraglacial debris-flow sediment - NP
pahoehoe lava	supraglacial melt-out till - NP
parna	supraglacial till - NP
peat	syncline
pedisediment	talus
permafrost	tephra
pillow lava	

thaw-sensitive permafrost  
thaw-stable permafrost  
till (glacial)  
tombolo  
topple deposit  
tor  
tuff  
valley fill  
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 - indicates terms that are NOT RECOMMENDED; NP - indicates terms that are NOT PREFERRED).

aeolian - NR	frost splitting - NR
accretion	frost stirring - NR
active layer	frost weathering - NR
active slope - NR	frost wedging - NR
aggradation	geomorphology
alluvial	gelifraction - NR
angle of repose	gelivation - NR
avalanche	glacial
avulsion	glacial epoch
backwearing	glacial marine sedimentation
block glide	glacial outburst flood (see <i>jokulhlaup</i> )
buried	glaciation
bypassed	Holocene
cat clay - NR	ice age - NR
colluvial	ice-rafting
competence	ice segregation
complex landslide	intramorainal
conformity	joint
conglifraction - NP	knickpoint
congliturbation - NR	landslide
constructional (geomorphology)	lateral spread
corrosion	lithification
creep	mass movement
cryoplanation	mass wasting – NP
cryoturbation	metastable slope - NR
cut and fill	Miocene
debris avalanche	mudflow
debris flow (mudflow)	nivation
debris slide	Oligocene
deflation	Paleocene
degradation	pedoturbation
deposition	periglacial
destructional (geomorphology)	Pleistocene
dip [structural geol.]	Pliocene
discontinuity	postglacial - NP
distal	proximal
earthflow	Quaternary
Eocene	recent
eolian	relict
erosion	rockfall
erosional (geomorphology)	rockfall avalanche
exfoliation	rotational landslide
exhumed	sand flow
extramrainic - NP	scour
extramrainal	scour and fill
extrusive	slide
fall	slope wash
flow	slump - NP
fluvial	soil creep - NP
frost bursting - NR	soil fall
frost churning - NR	solifluction
frost riving - NR	strike [structural geol.]
frost shattering	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.**<sup>1, 2</sup> (Schoeneberger et al, 2012)

ERA	Geologic Period	Geologic Epoch	Sub-Division	O Isotope Stage	Years (BP)
CENOZOIC	QUATERNARY	Holocene		(1)	0 to 10-12 ka*
		Late Pleistocene	Late Wisconsin	(2)	10-12 to 28 ka
			Middle Wisconsin	(3, 4)	28 to 71 ka
			Early Wisconsin	(5a - 5d)	71 to 115 ka
			Late Sangamon	(5e)	115 to 128 ka
		Pleistocene	Sangamon	(6 - 8)	128 to 300 ka
	Middle Pleistocene		(9 - 15)	300 to 620 ka	
	Early Pleistocene	Middle Pleistocene (Illinoian)	Mid Pleistocene	(16 - 19)	620 to 770 ka
			Early - Mid Pleistocene		770 ka to 2.6 Ma**
	TERTIARY	Neogene	Pliocene		
Miocene					5.3 to 23.0 Ma
Oligocene					23.0 to 33.9 Ma
Eocene					33.9 to 55.8 Ma
Paleocene					55.8 to 65.5 Ma
MESOZOIC	CRETACEOUS	Late Cretaceous			65.5 to 99.6 Ma
		Early Cretaceous			99.6 to 145.5 Ma
	JURASSIC			145.5 to 201.6 Ma	
	TRIASSIC			201.6 to 251.0 Ma	
	PERMIAN			251.0 to 299.0 Ma	
PALEOZOIC	PENNSYLVANIAN			299.0 to 318.0 Ma	
	MISSISSIPPIAN			318.0 to 359.0 Ma	
	DEVONIAN			359.0 to 416.0 Ma	
	SILURIAN			416.0 to 444.0 Ma	
	ORDOVICIAN			444.0 to 488.0 Ma	
	CAMBRIAN			488.0 to ≈ 542.0 Ma	
PRECAMBRIAN				> ≈ 542.0 Ma	

\* ka = x 1,000;

\*\* Ma = x 1,000,000

≈ = "approximately"

<sup>1</sup> Modified from Morrison, 1991; Sibrava, et al., 1986; and Harland, et al., 1990.<sup>2</sup> Modified from Walker, J.D., and Geidman, J.W. 2009.**REFERENCES**

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## 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
<b>Proglacial Till</b>  (at the front of, or in front of a glacier)	proglacial <b>flow till</b>	waterlaid <b>flow till</b>
<b>Supraglacial Till</b>  (on top of, or within upper part of a glacier)	supraglacial <b>flow till</b> <sup>1, 3</sup> supraglacial <b>melt-out till</b> <sup>1</sup>  (ablation till - NP) <sup>1</sup> (lowered till - NP) <sup>2</sup> (sublimation till - NP) <sup>2</sup>	-----
<b>Subglacial Till</b>  (within the lower part of, or beneath a glacier)	<b>lodgment till</b> <sup>1</sup> subglacial <b>melt-out till</b> subglacial <b>flow till</b> (= “squeeze till” <sup>2, 3</sup> )  (basal till - NP) <sup>1</sup> (deformation till - NP) <sup>2</sup> (gravity flow till - NP) <sup>2</sup>	waterlaid <b>melt-out till</b> waterlaid <b>flow till</b> iceberg till (= “ice-rafted”)

<sup>1</sup>*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 flow till*, etc. *Basal till* (any dense, non-sorted, subglacial till) is replaced by *lodgment till*, *subglacial melt-out till*, *subglacial flow till*, etc.

<sup>2</sup> 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).

<sup>3</sup> Also called *gravity flowtill* (Not Preferred).

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**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.)

<b>Pyroclasts and Pyroclastic Deposits (Unconsolidated)</b>			
Size Scale:    0.062 mm <sup>1</sup> 2 mm            64 mm <sup>1</sup>			
<----- <b>tephra</b> -----> (all ejecta)			
<----- <b>ash</b> ----->		<-- <b>cinders</b> <sup>2</sup> --> (specific gravity > 1.0 & < 2.0)	<--- <b>bombs</b> <sup>2</sup> ---> (fluid-shaped coarse fragments)
<-----> <b>fine ash</b>	<-----> <b>coarse ash</b>		
		<-- <b>lapilli</b> <sup>2</sup> --> (specific gravity > 2.0)	<--- <b>blocks</b> <sup>2</sup> ---> (angular-shaped coarse fragments)
		<----- <b>scoria</b> <sup>2</sup> -----> (slightly to moderately vesicular; specific gravity > 2.0)	
	<-----> <b>pumiceous ash</b> <sup>3</sup>	<----- <b>pumice</b> <sup>2</sup> -----> (highly vesicular; specific gravity < 1.0)	
<b>Associated Lithified (Consolidated) Rock Types</b>			
<-----> <b>fine tuff</b> <sup>1</sup>	<-----> <b>coarse tuff</b> <sup>1</sup>	<-- <b>lapillistone</b> <sup>1</sup> --> (sp. gr. > 2.0)	<--- <b>pyroclastic breccia</b> --->
<----- <b>welded tuff</b> ----->		<----- <b>agglomerate</b> -----> (rounded, volcanic coarse fragments)	
<----- <b>ignimbrite</b> -----> (ash-dominated flows and nuee ardentes)		<----- <b>volcanic breccia</b> -----> (angular, volcanic coarse fragments)	

<sup>1</sup> 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).

<sup>2</sup> 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).

<sup>3</sup> 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;

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