Hydrogeologic Framework of the Mesilla Basin Region of New Mexico, Texas, and Chihuahua (Mexico)—Advances in Conceptual and Digital-Model Development

Appendix G
Glossary of Commonly Used Scientific and Technical Terms in Publications on Basin and Range Province Hydrogeology

John W. Hawley

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New Mexico Water Resources Research Institute
New Mexico State University
MSC 3167, P.O. Box 30001

Las Cruces, New Mexico 88003-0001
(575) 646-4337
Email: nmwrri@nmsu.edu

APPENDIX G[1]

GLOSSARY OF COMMONLY USED SCIENTIFIC AND TECHNICAL TERMS IN PUBLICATIONS ON BASIN AND RANGE PROVINCE HYDROGEOLOGY*

John W. Hawley, Ph.D., Visiting Sr. Hydrogeologist,
New Mexico Water Resources Research Institute, NMSU
Emeritus Sr. Environmental Geologist, NM Bureau of Geology & Mineral Resources,
NM Institute of Mining & Technology hgeomatters@gmail.com

[1]APPENDIX G *in* Hawley, J.W., Swanson, B.H., Walker, J.S., Glaze, S.H., and Ortega Klett, C.T., 2025, Hydrogeologic Framework of the Mesilla Basin Region of New Mexico, Texas, and Chihuahua (Mexico)—Advances in Conceptual and Digital Model Development: NM Water Resources Research Institute, NMSU, Technical Completion Report No. 363, 359 p., 8 Appendices.

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APPENDIX G

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albite: A colorless or milky-white triclinic mineral of the plagioclase feldspar group: $Na_{1.0\text{-}0.9}Ca_{0.0\text{-}0.1}Al_{1.0\text{-}1\text{-}1}Si_{3.0\text{-}2.9}O_8$. It is the most acidic variety of plagioclase with composition ranging from $Ab_{100}An_0$ to $Ab_{90}An_{10}$; . . . (p. 13[4]).

alkali flat: A level area or *plain* in an arid or semiarid region, encrusted with alkali salts that become concentrated by evaporation and poor drainage; e.g., *salina* (p. 15[4]).

allostratigraphic unit: A mappable stratiform body of sedimentary rock that is defined and identified on the basis of its bounding discontinuities. Allostratigraphic units, in order of decreasing rank are allogroup, alloformation, and allomember. The fundamental unit is the **alloformation** (North American Commission on Stratigraphic Nomenclature (NACSN 2005, Art. 58) . . . (p. 18[4]).

alluvial: Pertaining to material or processes associated with transportation or deposition of running water.

alluvial basins: Relatively flat "valleys [flat-floored *basins*]" underlain by thick alluvial deposits [and] separated by elongated, discontinuous mountain ranges composed, in part, of sedimentary rocks of Paleozoic and Mesozoic age and, in part, of volcanic rocks of Cenozoic age (Heath 1988, p. 21). The term has been used by the USGS for parts of the southern Basin and Range physiographic province that comprise the Mexican Highland section, as well as the Rio Grande rift tectonic province (Wilkins 1986, p. 2).

alluvial fan: A construction piedmont landform that is composed of a body of stream deposits whose surface is a segment of cone. The cone's apex is located at the point where the stream emerges from a canyon or narrow valley in source-mountain highland. The distributary streams that constructed the fan radiate downstream from the cone's apex. Common longitudinal profiles are gently sloping and nearly linear. The proximal part of a fan is the area closest to the source upland, while the distal part is the farthest away.

alluvial flat (aka adobe flat): A generally narrow *plain* formed by sheetflood deposition of fine sandy clay or "adobe" brought down by an *ephemeral stream*, and having a smooth hard surface (when dry) usually unmarked by stream channels (p. 9[4]).

alluvium: Unconsolidated *clastic* material deposited by running water, including gravel, sand, silt, clay, and various mixtures of these. (*cf. valley fill*)

andesite: Dark-colored, fine-grained *extrusive* [*igneous*] rock that . . . contains phenocrysts composed primarily of zoned sodic plagioclase (esp. andesine) and one or more mafic minerals (e.g., biotite, hornblende, pyroxene), with a groundmass generally composed of the same minerals as the phenocrysts . . . and quartz is generally present; the extrusive equivalent of *diorite* (p. 24[4]).

anorthite: A white or grayish triclinic mineral of the plagioclase feldspar group: $Na_{.0.1\text{-}0.0}Ca_{0.9\text{-}1.0}Al_{1.9\text{-}2}Si_{2.1\text{-}2.0}O_8$. It is the most basic variety of plagioclase with composition ranging from $Ab_{10}An_{09}$ to $Ab_{10}An_{90}$; . . . (p. 27[4]).

Anthropocene: A still-informally used term for the present (post-*Quaternary*) period of geologic time, which extends from the end of the *Holocene* Epoch (about 1950 CE) into the future. It is characterized by marked intensification of human impact, associated with global industrialization, becoming the predominant factor in pushing fundamental parts of the Earth System out of the conditions that prevailed over the great extent of the *Holocene*. This is most clearly seen in the pattern of the abrupt rise in atmospheric CO_2 and CH_4 to levels and rates of increase not seen, not only in the *Holocene* and *Late Pleistocene*, but throughout the preceding 2.6 million years of the *Quaternary* (Ice Age) System/Period (p. 19[9]).

aquiclude: A saturated geologic formation [of very low permeability] that contains water but does not transmit significant quantities (p. 277[2]).

aquifer: Typically saturated regions of geologic materials, which can produce an economically feasible quantity of water (e.g., saturated media with high hydraulic conductivity such as sand and gravel or fractured bedrock or karstic systems) (p. 151[2b]).

aquitard: A [saturated] geologic unit that has very low hydraulic conductivity and restricts the flow from on aquifer to another (p. 151[2b]).

arroyo: The flat-floored channel of an ephemeral stream, commonly with very steep to vertical banks cut in alluvium (regional term - Southwest; syn. dry wash). NOTE: Where arroyo reaches intersect zones of groundwater discharge they are more properly classed as intermittent stream channels.

ash (volcanic): Fine *pyroclastic* material under 4.0 mm diameter.

asthenosphere: The layer or shell of the Earth below the *lithosphere*, which is weak and in which isostatic adjustments take place, *magmas* may be generated, and seismic waves are strongly attenuated. It is a part of the [Earth's] upper mantle (p. 40[4]).

bajada (*Mex Span.*): A steep curved descending road or trail (p. 116[6]).

bajada (*U.S. Geog.*): A broad alluvial slope extending from the base of a mountain range [or high escarpment] out into a basin and formed by coalescence of separate alluvial fans.

barreal [barrial] (*Mex Sp):** The silty to clayey bottom of an [*endorheic*] basin that is temporarily flooded after infrequent torrential rains (p. 125[7]); **heavy clay lands* (p. 123[6]).

basalt: A general term for dark-colored, [fine-grained] mafic *igneous* rocks, commonly extrusive but locally intrusive (e.g., dikes [and plugs]), composed chiefly of calcic plagioclase and clinopyroxene; the extrusive equivalent of *gabbro* (p. 55[4]).

basanite: A group of basaltic rocks characterized by calcic plagioclase, clinopyroxene, a feldspathoid, and olivine (>10%) (p. 56[4]).

basin (intermontane): A broad structural lowland between mountain ranges, commonly elongated and many miles across. Major component landforms are *basin floors* and *piedmont slopes*. Floors of internally drained basins (*bolsons*) contain one or more closed depressions, with temporary lakes (*playas, barreals*), and alluvial plains. In basins with through drainage, alluvial plains are dominant and lakes are absent or of small extent. Piedmont slopes comprise erosional surfaces adjacent to mountain fronts (*pediments*) and constructional surfaces made up of individual and/or coalescent *alluvial fans*. (*cf. valley*)

basin fill: The sediment deposited by any agent (water, wind, ice, mass wasting) so as to fill or partly fill an *intermontane basin*. Basin-fill deposits may be unconsolidated (non-indurated) or partly consolidated/indurated. (*cf. induration, valley fill*)

basin floor: A general term for the nearly level to gently sloping, bottom surface of an intermontane *basin (bolson)*. Component 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, alluvial plains are dominant and lake plains are absent or of limited extent. Basin floors grade mountainward to distal parts of *piedmont slopes*.

bedrock: The solid rock (*igneous*, *sedimentary*, or *metamorphic*) that underlies the soil and other unconsolidated material or that is exposed at the surface.

bolson [bolsón-*Mex Sp*]: An internally drained (closed), intermontane *basin* with two major land-form components: *basin floor* and *piedmont slope*. The former includes nearly level *alluvial* plains and playa-lake depressions. The latter comprises slopes of erosional origin adjoining the mountain fronts (*pediments*) and complex constructional surfaces (bajadas) mainly composed of individual and/or coalescent alluvial fans. Regional term (Southwest) derived from *balsa* (*Sp*.) – bag, purse, pocket.

braided channel or stream (floodplain landforms): 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 the strands of a complex braid. Braiding is generally confined to broad, shallow streams of low sinuosity, high bedload non-cohesive bank material, and 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. (*cf. floodplain landforms*)

breccia: A coarse-grained clastic rock, composed to angular broken rock fragments held together by a mineral cement or fine-grained matrix (p. 83[4]).

bulk precipitation: Commonly used to denote the geochemically active mixture of rainfall (or snowfall) and dry [dust] fallout (p. 54[8]).

calcite: A common rock-forming mineral: $CaCO_3$ . . . It is the principal constituent of limestone; . . . (p. 92[4]).

calcrete: A general term for a prominent zone of secondary carbonate accumulation in surficial materials of warm subhumid to arid areas 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 (carbonate, silicate, sulphate) may be present as accessory cements. (*cf. induration*)

canyon: A long, deep, relatively narrow, steep-sided valley confined between high walls in a plateau or mountainous area (p. 95[4]).

capillary fringe: A zone immediately above the *water table* in which the pores are filled with water, but the water is under pressure less than atmospheric (p. 278[2a]).

Cenozoic: The present Era of geologic time, which comprises the *Tertiary* and *Quaternary* Periods, has age range of about 65.5 Ma, and is preceded by the *Cretaceous* Period of the *Mesozoic* Era (65.5-251 Ma)[5].

cerro: Hill (p. 202[6]).

chert: A hard, extremely dense or compact, dull to semivitreous, microcrystalline to cryptocrystalline sedimentary rock, consisting dominantly of interlocking crystals of quartz less than 30 μm in diameter; it may contain amorphous silica (opal) (p. 111[4]).

chlorite: A group of platy, monoclinic, usually greenish minerals with the general formula: $(R_{3+}, R_{2+})_{4-6}$ $(Si,Al)_4 O_{10} (OH,O)_8$ . . . (p. 113[4]).

cienegas: Perennial or intermittent wetlands located in places where the zone of saturation intersects an undissected valley- or basin-floor surface.

cinder cone: A conical hill formed by the accumulation of volcanic ejecta, with slopes usually steeper than 20 percent.

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

clastic: Pertaining to a rock or sediment composed mainly of fragments derived from preexisting rocks or minerals and moved from their place of origin. (*cf. detritus, epiclastic, pyroclastic*)

clay: A rock or mineral fragment (often a crystalline fragment of a clay mineral) having a diameter of less than 0.002 mm (2 microns); an aggregate of clay-size particles that is usually characterized by high water content and plasticity.

coarse-grained: A sediment or clastic sedimentary rock whose particles have an average diameter of greater than 2 mm.

colluvium: Unconsolidated earth material deposited on and at the base of steep slopes by mass wasting (direct gravitational action) and local unconcentrated runoff.

confined aquifer: A permeable formation whose upper boundary is an *aquitard*; water in a well within a *confined aquifer* will rise above the top of the *aquifer* (p. 279[2]; *cf.* potentiometric surface).

conglomerate: A coarse-grained, *clastic* 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. (*cf.* breccia)

conservation: A careful preservation and protection of something; *especially* planned management of a natural resource to prevent exploitation, destruction, or neglect, e.g., *water conservation.*

coquina: A detrital limestone composed wholly or chiefly of mechanically sorted and water-transported fossil debris (p. 142[4]).

crust (interior Earth): The outermost layer or shell of the Earth; . . . (p. 153[4]).

dacite, rhyodacite: A fine-grained *extrusive* rock with the same general composition as *andesite* but having less calcic plagioclase and more quartz; . . . the extrusive equivalent of *granodiorite* (p. 163[4]).

debris: Any surficial accumulation of loose material detached from rock masses by chemical and mechanical means, as by decay and disintegration, and occurring in the place where it was formed, or transported by water or ice and redeposited. It consists of rock fragments, finer-grained earth material, and sometimes organic matter.

debris flow (mudflow): A mass movement process (*or depositional product*) involving rapid flowage of highly viscous mixtures of *debris*, water, and entrapped air. Water content may range up to 60. A mudflow is a type of debris flow with *clastic* particles of sand size and finer. (*cf. alluvial fan*)

diagenesis: Process involving physical and chemical changes in a sediment after deposition that converts it to consolidated rock; includes compaction, cementation, recrystallization, and replacement.

diatreme: A funnel-shape breccia pipe that reaches as much as 2,500 m [8,200 ft] in depth. Diatremes are thought to form by hydrovolcanic fragmentation and wall-rock collapse. Diatremes may underlie maars and grade at depth into dikes (p. 170[4]). (*cf. maar*)

dike (igneous): A tabular igneous intrusion that cuts across bedding or foliation of the country rock (p. 180[4]).

distributive fluvial system (DFS): Pertaining to *fluvial* systems that are "generally not confined to valleys and have a clear apex from which active and abandoned channelbelts radiate outward to form a positive topographic feature centered on this apex. Channels have no tributaries on the DFSs and commonly decrease in size downstream . . . due to bifurcation, infiltration, and evaporation." (p. 327[11])

dolomite: A carbonate *sedimentary rock* of which more than 50% by weight consists of the mineral *dolomite* [$CaMg(CO_3)_2$] (p. 189[4]). (*cf. limestone*)

dune: A mound, ridge, or *hill* of loose, windblown granular material (generally sand), either bare or covered with vegetation.

dust: Dry, solid matter consisting of clay- and silt-size particles (<62 microns) that are so finely divided that they can be readily lifted and transported by the wind (adapted from p. 197[4]).

echo [sand-] dune: A dune formed in front of a continuous [bedrock] object, such as a wind-facing cliff [or mountain front], and at distance slightly less than the obstacle's height, because of the formation of the reverse eddy (Neuendorf et al. 2005, p. 201).

eluvial horizon: A soil horizon from which material has been removed by the process of *eluviation* (p. 207[4]). (*cf.* illuvial horizon, illuviation)

eluviation: The removal of soil material in suspension (or in solution) from a layer or layers of soil (p. 207[4]). (*cf.* illuvial horizon, illuviation)

endorheic: Pertaining to a topographic closure of a surface-drainage basin. (*cf. exorheic*)

environmental geology: A specialty of geology concerned with earth processes, earth resources, and engineering properties of earth materials and relevant to (1) protection of human health and natural ecosystems from adverse biochemical and/or geochemical reactions to naturally occurring chemicals or to chemicals or chemical compounds released into the environment by human activities, and (2) the protection of life, safety, and well-being of humans from natural processes, such as floods, hurricanes, earthquakes, and landslides, through land-use planning (p. 212[4]).

eolian: Pertaining to material transported and deposited by the wind. Includes earth materials ranging from dune sands to silty loess deposits.

ephemeral stream: A stream or reach of a stream that flows briefly only in direct response to precipitation in the immediate locality and whose channel is at all times above the *water table* (p. 213[4]).

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. (*cf. volcaniclastic*)

erosion: The wearing away of the land surface by running water, waves, moving ice and wind, or by such processes as mass wasting and corrosion (solution and other chemical processes).

erosional (geomorphology): Owing its origin, form, position or general character to wearing-down (degradational) processes, such as removal of weathered rock debris by any mechanical or chemical processes to form, for example, a *pediment* or valley-side slope. Running water is the dominant agent of erosion in arid and semiarid regions.

evaporite: A sedimentary rock composed primarily of minerals produced from evaporation of a saline solute: e.g., gypsum-gypsite and halite-salt (p. 221[4]).

exorheic: Pertaining to an open surface-drainage basin. (*cf. endorheic*)

extrusive: Denoting *igneous* rocks derived from deep-seated molten matter (magmas) emplaced on the Earth's surface. (*cf. intrusive; volcanic*)

facies (stratigraphy): The sum of all primary lithologic and paleontologic characteristics exhibited by a sedimentary rock and from which its origin and environment of formation may be inferred; the general nature or appearance of a sedimentary rock produced under a given set of conditions; a distinctive group of characteristics that distinguishes one group from another within a stratigraphic unit. (e.g., contrasting river-channel facies and overbank-flood-plain facies in alluvial valley fills. *cf. lithofacies assemblage, lithosome*)

fan piedmont: A broad, gently inclined, piedmont slope formed by lateral coalescence of a series of *alluvial fans*, and having a broadly undulating transverse profile (parallel to the mountain front) due to the convexities of component fans. The term is generally restricted to constructional slopes of intermontane basins in the southwest USA.

fault, fault zone: A fracture or fracture zone of the earth with displacement along one side in respect to the other. Normal faults have dip-slip (near-vertical) displacement, while strike-slip faults have near-horizontal displacement. Faults may bifurcate into "strands."

feldspar: A group of abundant rock-forming minerals of general formula: $MAI(Si,Al)_3O_8$, where M = K, Na, Ca, Ba, Rb, Sr, or rarely Fe. Feldspars are the most widespread of any mineral group and constitute 60% of the Earth's crust; they occur as components of all kinds of rocks (crystalline schists, migmatites, gneisses, granites, most magmatic rocks) . . . A mineral of the feldspar group, such as alkali feldspar (orthoclase, microcline) [and] plagioclase (albite, anorthite) . . . (p. 232[4]).

feldspathoid: A group of comparatively rare rock-forming minerals consisting of aluminosilicates of sodium, potassium or calcium and having too little silica to form feldspars (p. 233[4]).

felsic: A mnemonic adjective derived from *fe*ldspar + *le*nad (feldspathoid) + *silica* + *c*, and applied to an *igneous* rock having abundant light-colored minerals in its mode; also, applied to those minerals (quartz, feldspars, feldspathoids, muscovite) as a group. It is a compliment to *mafic* (p. 233[4]). (*cf. silicic*)

fine-grained: A sediment or clastic sedimentary rock whose particles have an average diameter of less than 0.5 - 0.62 mm (i.e., less than sand size).

flat (geomorph.): A general term for a level or nearly level surface or a small tract of land marked by little or no relief; e.g., *alkali flat* or *valley* flat (p. 241[4]).

floodplain: The nearly level alluvial 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 stream.

floodplain landforms: A variety of constructional and erosional features produced by stream channel migration and flooding. (e.g., backswamps, *braided channels and streams*, *floodplain* splays, *meander*, meander belt, meander scrolls, oxbow lakes, natural levees, and valley flats).

flow capacity: The maximum amount of *groundwater* recharge that an aquifer system can receive and transmit. It occurs in arid-region groundwater basins when the *water table* is at land surface, and where there is maximum recharge available in its *terrain* (p. 89[10]).

fluvial: Of or pertaining to rivers [perennial streams]; produced by river action, as a fluvial plain. (riverine-synonym).

footslope: General term for the lowermost erosional component if a hillslope geomorphic sequence (e.g., summit/shoulder/backslope/footslope/[depositional]toeslope).

Formation (stratigraphy): The basic rock-stratigraphic 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 by mappability at the Earth's surface (at scales on the order of 1:25,000) or traceability in the subsurface. (*cf. Group* and *Member*)

fossil water: Fossil water or paleowater is an ancient body of water that has been contained in some undisturbed space, typically groundwater in an aquifer, for millennia.

geographic information science: Geographical information science (GIScience or GISc) is the scientific discipline that studies the techniques to capture, represent, process, and analyze geographic information. It can be contrasted with geographic information systems (GIS), which are software tools.

geographic information system: A geographic information system (GIS) is a computer system that analyzes and displays geographically referenced information. It uses data that is attached to a unique location. Most of the information we have about our world contains a location reference: Where are USGS stream gages located? Where was a rock sample collected?

geography: The science that deals with the description, distribution, and interaction of the diverse physical, biological, and cultural features of the earth's surface.

geohydrology: The branch of *hydrology* which studies underground fluids and their interaction with solid geologic materials (p. 433[1]).

geology: The study of the planet Earth, the materials of which it is made, the processes that act on these materials, the products formed, and the history of the planet and its life forms since its origin (p. 267[3]).

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.

geopolitics*: (1) a study of the influence of such factors as geography, economics, and demography on the politics and especially the foreign policy of a state; (2) a governmental policy guided by geopolitics; 3) a combination of political and geographic factors relating to something (such as a state or particular resources [e.g., water].
**Adapted from: https://www.merriam-webster.com/dictionary/geopolitics*

gilgai: The microrelief of small basins . . . and ridges on a soil surface produced by expansion and contraction during wetting and drying of clayey soils that contain smectite (p. 271[4]).

global positioning system: The Global Positioning System (GPS), . . ., is a satellite-based radionavigation system owned by the United States government and operated by the United States Space Force. It is one of the global navigation satellite systems (GNSS) that provides geolocation and time information to a GPS receiver anywhere on or near the Earth where there is an unobstructed line of sight to four or more GPS satellites. It does not require the user to transmit any data, and operates independently of any telephonic or Internet reception, though these technologies can enhance the usefulness of the GPS positioning information. . . . Although the United States government created, controls and maintains the GPS system, it is freely accessible to anyone with a GPS receiver.

graben: An elongate, relatively depressed [earth-] crustal block that is bounded by [normal] *faults* on its long sides. (*cf. half graben, horst*)

granite: A plutonic rock in which quartz constitutes 10 to 50 percent of the *felsic* components and in which the alkali [potassium] feldspar/total feldspar ratio is generally restricted to the range of 65 to 90 percent. . . . Broadly applied, any holo [coarse-] crystalline quartz-bearing *plutonic* rock (p. 279[4]).

granodiorite: A group of coarse-grained *plutonic* rocks intermediate in composition between quartz diorite and quartz monzonite, containing quartz [20 to 60 percent], plagioclase, and potassium [alkali] feldspar, with biotite, hornblende, or, more rarely, pyroxene as the *mafic* components. The intrusive equivalent of *rhyodacite* [and *dacite*] (p. 279[4]).

gravel: An unconsolidated aggregate of *clastic* particles with diameters greater than 2 mm. Granule gravel (granules) range from 2 to 4 mm, pebbles from 4 to 64 mm, cobbles from 64 to 256 mm (2.5 to 10 in.), and boulders greater than 256 mm (10 in).

groundwater: (1) (a) That part of the *subsurface water* that is in the saturated zone . . . (b) loosely, all *subsurface water* as distinct from *surface water* (p. 286[4]). (2) Any *subsurface* aqueous fluid, either saline or fresh (p. 433[1]). *See* "*mining GW"*

groundwater sapping: A geomorphic erosion process that results in the headward migration of channels in response to near constant fluid discharge at a fixed point. . . . Erosion by sapping tends to produce steep-sided U-shaped valleys of fairly uniform width with box-like, "theater-shaped" headwalls. (*cf.* Nash 1996)

Group (stratigraphy): The formal rock-stratigraphic unit in the local classification of mappable rocks that is next in rank above a *Formation*.

gypsite: A partly indurated variety of *gypsum* commonly with clay to fine-sand impurities.

gypsum: A widely distributed mineral consisting of aquated calcium sulfate: $CaSO_4.2H_2O$ (p. 289[4]).

half graben: An elongate, asymmetrical trough or *basin* bounded [on one side] by a normal *fault* (p. 290[4]; *cf. graben*).

halite: Sodium chloride: NaCl; common salt.

heuristic: (1) A heuristic or heuristic technique (Ancient Greek: εὑρίσκω, heurískō, 'I find, discover'), is any approach to problem solving or self-discovery that employs a practical method that is not guaranteed to be optimal, perfect, or rational, but is nevertheless sufficient for reaching an immediate, short-term goal or approximation. Where finding an optimal solution is impossible or impractical, heuristic methods can be used to speed up the process of finding a satisfactory solution. Heuristics can be mental shortcuts that ease the cognitive load of making a decision.

heuristic: (2) Involving or serving as an aid to learning, discovery, or problem-solving by experimental and especially trial-and-error methods [*heuristic* techniques . . .]; *also***:** of or relating to exploratory problem-solving techniques that utilize self-educating techniques (such as the evaluation of feedback) to improve performances [*heuristic* computer program].

historical geology: A major branch of *geology* that is concerned with the evolution of the Earth and its life forms from its origin to the present day (Neuendorf et al. 2005, p. 302).

Holocene: The second epoch of the *Quaternary* Period of geologic time, extending from the end of the *Pleistocene* Epoch (about 11.7 thousand years ago [ka])[5] to the present; also, the corresponding (time-stratigraphic) "series" of earth materials. (syn. *post-glacial*)

horst: An elongate [crustal] block that is bounded by faults on both sides by normal *faults* that dip away from each other (p. 307[4]; *cf. half graben, horst*).

hydrogeology: The [branch of geology] that deals with *subsurface* waters and related geologic aspects of surface waters. Also used in the more restricted sense of groundwater geology only. (p. 311)[4].

hydrology: The study of the occurrence and movement of water on and beneath the surface of the Earth, the properties of water, and its relationship with living and material components of the environment (p. 282[2a]).

hydrostatic level: The level to which water will rise in a well under its full [hydrostatic] pressure head. It defines the *potentiometric surface* (p. 313[1]).

hydrostatic pressure: The pressure exerted by the water at any given point in a body of water (p. 313[1]).

hydrostratigraphic unit: A body of rock having considerable lateral extent and composing "a geologic framework for a reasonably distinct hydrologic system (Maxey 1964, p. 126[3])." "A hydrostratigraphic unit may represent an entire stratigraphic unit, a portion of a stratigraphic unit, or a combination of adjacent stratigraphic units with consistent hydraulic properties" (Giles and Pearson 1998, p. 322[3]).

hydrostratigraphic unit [HSU][4]: In this Report HSUs are mappable, primarily intermontane *basin-fill* deposits grouped on the basis of *lithofacies* composition and position in both lithostratigraphic and time [chrono-] stratigraphic contexts. (*cf.* stratigraphy, lithofacies assemblage)

hydrovolcanic: Term encompassing all volcanic activity that results from the interaction between lava, magmatic heat, or gases and meteoric or connate water at or near the surface of the Earth (p. 313[4]).

hypabyssal: An igneous rock or intrusive body formed at a shallow depth (p. 314[4]).

igneous rock: Rock formed by solidification from a molten or partially molten state; major varieties include *plutonic* and volcanic rocks; examples: andesite, basalt, granite. (*cf.* intrusive, extrusive)

illuvial horizon: A soil horizon from which material has been added by the process of *illuviation* (p. 321[4]). (*cf.* eluvial horizon, eluviation)

illuviation: The accumulation, in a lower soil horizon, of soluble or suspended material that was transported from an upper soil horizon by the process of *eluviation* (p. 321[4]). (*cf.* illuvial horizon)

induration: The process of hardening of sediments or other rock aggregates through cementation, pressure, heat, and other causes. (*cf. lithification*)

intermittent stream: A stream or reach of a stream that flows only at certain times of the year, as when it receives water from springs or some surface source (p. 332[4]).

isopach: A line drawn on a map through points of equal true thickness of a designated stratigraphic unit or group of stratigraphic units (p. 340[4]). (*cf.* lithofacies assemblage)

isopach map: A map that shows the thickness of a bed, formation, sill, or other tabular body throughout a geographic area by means of isopachs at regular intervals (p. 340[4]). (*cf. lithofacies assemblage*)

isopleth map: A general term for any map showing the areal distribution of some variable quantity in terms of lines of equal or constant value (p. 340[4]). Isopleth maps in this Report show the primary *lithofacies* composition of a designated *hydrostratigraphic unit* depicted on an *isopach map*.

karst: A type of topography that is formed on limestone, gypsum, and other soluble rocks, primarily by dissolution. It is characterized by sinkholes, caves, and underground drainage. . . . (p. 348[4]).

karstic: Pertaining to or having the properties of *karst* (p. 349[4]).

keratophyre: A name generally applied to *salic extrusive* and hypabyssal rocks characterized by the presence of *albite*, or albite-*oligoclase* and *chlorite*, *epidote*, and *calcite*, all of metamorphic origin (p. 350[4]).

lacustrine deposit: *Clastic* sediments and chemical precipitates originally deposited in lakes.

laguna (*Sp*): A Spanish term for a "minor lake" used in the SW U.S. for a lake or lagoon; esp., a shallow *ephemeral* lake in the lowest part of a *bolson*, fed by streams rising in neighboring mountains and flowing as the result of rainstorms (p. 358[4]).

landform: Any physical, recognizable form or feature of the Earth's surface, having a characteristic shape, and produced by natural causes; it includes major forms such as a *plain*, *plateau*, or *mountain*, and minor forms such as a *stream terrace*, *hill*, *valley*, or *dune*. Taken together, the landforms make up the surface configuration of the earth. The "landform" concept involves both empirical description of a terrain class and interpretation of genetic factors ("natural causes").

landscape: All the natural features, such as field, hills, forests, and water that distinguish one part of the Earth's surface from another part; usually that portion of land which the eye can comprehend in a single view, including all of its natural characteristics. Geology: The distinct association of landforms, especially as modified by geologic forces that can be seen in a single synoptic view (e.g., parts of a satellite image).

Laramide orogeny: A time of subcontinental-scale earth-crustal deformation, typically recorded in the eastern Rocky Mountain and southeastern Basin and Range provinces, whose several phases occurred approximately 80 to 50 Ma. In the American Southwest, Laramide structures include thick-skinned basement-cored uplifts and monoclinal folds, both of crustal-compressional origin. (*cf.* Haenggi 2002, Seager 2004)

latite: A porphyritic *extrusive* rock having phenocrysts of plagioclase and potassium feldspar (probably mostly sanidine) in nearly equal amounts, little or no quartz, and a finely crystalline to glassy groundmass; the extrusive equivalent of *monzonite* (p. 363[4]).

limestone: A carbonate *sedimentary rock* of which more than 50% by weight of calcium carbonate, primarily in the form of the mineral *calcite* (p. 371[4]). Limestones are usually formed by a combination of organic and inorganic processes and include chemical and *clastic* (soluble and insoluble) constituents; many are fossiliferous. (*cf. dolomite*)

lithification: The conversion of a newly deposited, unconsolidated sediment into a coherent and solid rock, involving processes such as cementation, compaction; desiccation, crystallization, recrystallization, and compression. It may occur concurrent with, or shortly or long after deposition. (*cf. induration*)

lithofacies: A lateral, mappable subdivision of a designated stratigraphic unit, distinguished from adjacent subdivisions on the basis of *lithology*, including all mineralogic and petrographic characters . . . that influence the composition, or texture of the rock; a *facies* characterized by particular lithologic features. Laterally equivalent lithofacies may be separated by vertical arbitrary cut-off planes, by intertonguing surfaces or by gradational changes (p. 357[4]). (*cf. stratigraphy, hydrostratigraphic unit, lithofacies assemblage*)

lithofacies assemblages (LFAs in this Report): Genetically related lithofacies groups that are defined primarily on the basis of grain-size distribution, mineralogy, sedimentary structures, and degree of post-depositional alteration (*diagenesis*). Inferred environments of deposition form the secondary basis for their definition. Lithofacies assemblages are the primary components of a *hydrostratigraphic unit (HSU)*, and have distinctive geophysical, geochemical, and hydrologic attributes. As such they provide a mechanism for schematically illustrating distribution patterns of aquifers and confining units in the hydrogeologic maps and cross-sections. (*cf. isopach* and *isopleth maps)*

lithologic: Pertaining to the physical character of a rock, or unconsolidated earth material.

lithosphere: The outer, relatively ridged layer of the Earth that respond to emplacement od load by flexural bending, The lithosphere consists of the entire *crust*, plus the uppermost *mantle*. The lithosphere is broken into about 20 plates. According to the theory of "plate *tectonics*," motion and interaction of lithosphere plates is responsible for most geologic activity (p. 376[4]).

loma (*Sp*): hillock, low ridge (p. 609[6]).

maar: A low-relief, broad volcanic crater formed by multiple shallow explosive [*hydrovolcanic*] eruptions. It is surrounded by a crater [tuff] ring, and may be filled with water (p. 386[4]). (*cf. diatreme*)

mafic: . . . an *igneous* rock composed chiefly of one or more ferromagnesian, dark-colored minerals in its mode [e.g., *andesite*, *basalt*; also, applied to those minerals]. A mnemonic adjective derived from *ma*gnesium + *f*erric) + *ic*. It is a complement to *felsic* (p. 387[4]).

magma: Naturally occurring molten or partially molten rock material, generated within the Earth and capable of intrusion and extrusion, and which igneous rocks are derived through solidification and related processes (p. 388[4]).

malpais: A term use in the southwestern U.S. and Mexico for a region of rough and barren [basaltic] lava flows (p. 392[4]).

mantle [interior Earth]: The zone of the Earth below the *crust* and above the core, which is divided into the upper and lower mantle, with a transition zone between (p. 393[4]).

meander, meandering channel: A meander is one of a series of sinuous loops, with sine-wave form, in the course of a stream channel. The term "meandering" should be restricted to loops with channel length more than 1.5 to 2 times the length of the wave form. Meandering stream channels commonly have cross-sections with low width to depth ratios, (fine-grained) cohesive 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*. (*cf. floodplain landforms*)

medium-grained: A sediment or clastic sedimentary rock whose particles have an average diameter of 0.5-0.62 to 2 mm (i.e., sand-size range).

Member (stratigraphy): The formal rock-stratigraphic unit in the local classification of mappable rocks that is next in rank below a *Formation*.

mesa: A broad, nearly flat-topped and usually isolated upland mass characterized by summit widths that are greater than the heights of bounding erosional escarpments. A *tableland* produced by differential erosion of nearly horizontal, interbedded weak and resistant rocks, with the latter comprising capping layers. As summit area decreases relative to height, mesas are transitional to *buttes*. In the American SW *mesa* is also commonly used to designate broad *structural benches* and alluvial *terraces* that occupy intermediate levels in stepped sequences of platforms bordering canyons and valleys. (*cf. plateau*)

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: marble, gneiss, quartzite, schist, slate.

microcline: A clear, white to gray, brick red, or green triclinic mineral of the alkali-feldspar group: $KAlSi_3O_8$. . . . Microcline is a common rock-forming mineral of granites and pegmatites, and is often secondary after orthoclase. . . . (p. 410[4]).

mining groundwater: Extraction of groundwater faster than it can be recharged (p. 435[1]).

Miocene: The next to last epoch of the *Tertiary* Period of geologic time, following the *Oligocene* and preceding the *Pliocene* Epochs (about 23 to 5 million years ago [Ma])[5]; also, the corresponding (time-stratigraphic) "series" of earth materials.

mirabilite: A white or yellow monoclinic mineral: $Na_2SO_4.10H_2O$. It commonly occurs in a residue from saline/alkali lakes, *playas*, *salinas,* and springs; or as an efflorescence (p. 416[4]).

monzonite: A group of [coarse-grained] *plutonic* rocks intermediate in composition between syenite and diorite monzonite, containing approximately equal amounts of alkali feldspars and plagioclase, little or no quartz, and augite [a pyroxene] as the main *mafic* mineral; the intrusive equivalent of *latite* (p. 422[4]).

mudstone: A *sedimentary rock* formed by induration of *silt* and *clay* in approximately equal proportions.

obsidian: A black or dark-colored volcanic glass, usually of rhyolite composition, characterized by conchoidal fracture (p. 446[4]).

oligoclase: A triclinic mineral of the plagioclase feldspar group with composition ranging from $Ab_{90}An_{10}$ to $Ab_{70}An_{30}$. It is common in igneous rocks of intermediate to high silica content (p. 450[4]).

olivine: an olive-green, grayish-green, or brown orthorhombic mineral: $(Mg,Fe_2)Si0_2$ (p. 450[4]).

opal: A mineral or mineral gel: $SiO_2.nH_2O$. . . . It differs from quartz in being isotropic, and has a lower refractive index, and is softer and less dense (p. 452[4]).

orthoclase: A colorless, white, cream-yellow, flesh-pink, or gray monoclinic mineral of the alkali-feldspar group: $KAlSi_3O_8$. . . . Ordinary orthoclase is a common rock-forming mineral; it occurs especially in granites, acid-igneous rocks, and crystalline schists; . . . (p. 458[4]).

paso (*Sp Geog*): pass (p. 734[6]).

pass (geomorph): A natural passageway through high difficult terrain (p. 474[4]). (*cf. water gap, wind gap*)

pediment: A gently sloping *erosional* surface developed at the foot of a receding *hill* or *mountain* slope. The surface may be essentially bare, exposing earth material that extends beneath adjacent uplands; or it may be thinly mantled with *alluvium* and *colluvium*, ultimately in transit from upland front to basin or valley lowland. The term has been used in several geomorphic contexts: Pediments may be classed with respect to: (1) landscape position, for example *intermontane-basin* piedmont or valley-border footslope surfaces, (2) type of material eroded, *bedrock* or *basin fill*, or 3) combinations of the above.

pelecypod: Any benthic aquatic mollusk with a bivalve shell.

perennial stream: A stream or reach of a stream that flows continuously throughout the year, and whose upper surface generally stands lower than the water table in the region adjoining the stream (p. 481[4]).

petrography: The branch of geology dealing with the systematic description and classification of rocks; including their microscopic study and description.

petrology: A general term for the study by all available methods of the natural history of rocks, including their origins (petrogenesis), description, and classification (petrography).

Phanerozoic: The uppermost unit of the Standard Global Chronostratigraphic Scale. It comprises the *Paleozoic*, *Mesozoic*, and *Cenozoic* erathems, which include rocks with abundant evidence of life. . . . The *Phanerozoic Eon* covers a time span that extends between 540 Ma[5] and the present (p. 489[4]). (*cf. Proterozoic*)

phenocryst: A relatively large, conspicuous crystal in a porphyritic rock [one with a finely crystalline groundmass] (p. 489[4]).

phreatic water: (1) A term that was originally applied only to the water that occurs in the upper part of the saturated zone under water-table conditions (syn. of *unconfined groundwater*); but (2) has come to be applied to all water in the saturated zone (i.e., groundwater) (p. 489[4]).

phreatomagmatic: Synonym of hydrovolcanic (p. 313 and 489[4]).

phreatomagmatic eruption: A volcanic explosion that extrudes both magmatic gases and steam; it is caused by the contact of magma with groundwater or shallow surface water (p. 489[4]).

physiographic province: A region in which all parts are similar in [basic] geologic structure and climate, and which has consequently a [relatively] uniform geologic history; a [large] region whose pattern of [major] relief features or landforms differs significantly from that of adjacent regions (*cf.* Fenneman and Johnson 1946, p. 490[4]). Provinces are commonly subdivided into sections. Examples in the North American West include the Basin and Range, Colorado Plateau, Great Plains, Rocky Mountains, and Sierra Madre Occidental (Hawley 2005).

picacho: peak, summit (p. 748[6]).

piedmont slope: 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: (1) an erosional surface on bedrock adjacent to the receding mountain front (pediment); (2) a constructional surface comprising individual alluvial fans and interfan valleys, also near the mountain front; and 3) a distal complex of coalescent fans (bajada), and alluvial slopes without fan form. Piedmont slopes grade to either basin-floor depressions with alluvial and temporary lake plains or surfaces of through drainage. (*cf. bolson*)

plagioclase: A group of triclinic feldspars of general formula: $(Na,Ca)[Al(Si,Al)Si_2O_8]$. . . . The plagioclase series is arbitrarily subdivided according to increasing mole fraction of the An component: Albite (An 0-10), oligoclase (An 10-30), andesine (An 30-50), oligoclase (An 50-70), laboradorite (An 70-90), and Anorthite (An 90-100). . . . Plagioclase minerals are among the commonest rock-forming minerals, have characteristic twinning, and commonly display zoning. . . . (p. 495[4]).

plain: An extensive lowland area that ranges from level to gently sloping or undulating. A plain has few or no prominent hills or valleys, and occurs at low elevation with reference to surrounding areas (local relief generally less than 100 m). (*cf. plateau*)

plateau: An extensive upland mass with relatively flat summit area that is considerably elevated (more than 100 m) above adjacent lowlands, and is separated from them on one or more sides by escarpments. A comparatively large part of a plateau surface is near summit level. (*cf. ceja, mesa, plain*)

playa (*Mex Sp*): beach (p. 771[6]).

playa (*U.S. Geog*): 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 be characterized by high water table and saline conditions. (*cf. sink*)

Pleistocene: The first epoch of the *Quaternary* Period of geologic time, following the *Tertiary Pliocene* Epoch and preceding the *Holocene* (approx. from 2.6 Ma to 11ka)[5]; also, the corresponding (time-stratigraphic) "series" of earth materials. Glacial-interglacial cycles characterized much of the *Pleistocene* in high latitude and altitude regions, while complex cool-moist, cold-dry, and hot-dry (pluvial-interpluvial) cycles occurred in the Southwest. Subdivided into early (2.6 - 0.75 Ma), middle (0.75 - 0.13 Ma), and late (130,000 - 11,000 ka) Pleistocene. (syns. Glacial epoch, Ice Age)

Pliocene: The last epoch of the *Tertiary* Period of geologic time, following the *Miocene* Epoch and preceding the *(Quaternary*) *Pleistocene* Epoch (about 5 to 2.6 Ma) [5]; also, the corresponding (time-stratigraphic) "series" of earth materials.

plutonic: Pertaining primarily to *igneous* rocks formed deep in the earth's crust, but also including associated *metamorphic* rocks. (*cf.* volcanic)

porphyry, porphyritic: An igneous rock of any composition that contains conspicuous phenocrysts in a fine-grained [finely crystalline] groundmass (p. 509[4]).

potentiometric surface: (1) A surface that depicts the distribution of hydraulic heads in a *confined aquifer*; the water [level] in a well or piezometer penetrating the *confined aquifer* defines that surface (p. 286[2a]). (2) Commonly defined more broadly to include the *water table*.

Precambrian: Designates all rocks older than the *Cambrian* Period of the Standard Global Chronostratigraphic Scale. It included the *Archean* and *Proterozoic* eons (p. 512[4]). (*cf. Proterozoic*)

Proterozoic: The upper Eon of the Precambrian of the Standard Global Chronostratigraphic Scale; above the Archean and below the *Phanerozoic* eons. Covers a geochronometric-time span between 2,500 and 540 Ma (p. 520[4]). (*cf.* Precambrian)

pumice: A light-colored vesicular glassy rock, usually having composition of rhyolite.

pyroclastic: Pertaining to fragmental materials produced by usually explosive, aerial ejection of clastic particles from a *volcanic* vent. Such materials may accumulate on land or under water. Pyroclastic rocks include tuff, welded tuff, and volcanic breccia (p. 527[4]). (*cf.* epiclastic, volcaniclastic)

quartz: Crystalline silica: SiO_2. It is, next to feldspar, the commonest rock-forming mineral (p. 489[4]).

Quaternary (Ice Age) Period: The youngest geologic time-rock unit with a span of about 2.6 Ma[5]. It comprises the *Holocene* (past 11.5 thousand years [ka]) and *Pleistocene* Epochs, and is preceded by the *Tertiary* Period. *Quaternary* and *Tertiary* are subdivisions of the *Cenozoic* Era[5]. Also, the corresponding (chronostratigraphic) "series-system" of earth materials.

resilience (Earth-environmental context): Resilience means working with–instead of fortifying against–nature and the greater community. It requires us to understand the patterns of how the natural environment works; and it demands that we design a built environment that aligns with those mechanisms for the long-term viability of humanity's investment (Penndorf 2018, p. 78).

rhyolite: A group of [*extrusive*] *igneous* rocks, typically porphyritic and commonly exhibiting flow texture, with *phenocrysts* of quartz and alkali [potassium] feldspar in a glassy to cryptocrystalline glassy groundmass; . . . the fine-grained equivalent of *granite* (p. 553[4]).

rift zone (tectonics): A region of [the Earth's] where extension results in formation of an array of kinematically related *faults*, along with associated *grabens*, *half grabens*, and *horsts*. Some active rift zones [like the RG rift] have associated volcanic activity. Some rift zones [like the RG rift] evolve into deep troughs filled with very deep sequences of *sediment*. Some [like the RG rift] are broad with distributed faults, whereas some are narrow with localized faulting (p. 555[4]).

rincón *(SP)*: corner (inside) (870[6]).

salic: Said of certain light-colored silicon- or aluminum-rich minerals present in the norm of igneous rocks; e.g., quartz, feldspars, and feldspathoids (p. 568[4]).

salina: A place where crystalline salt deposits are formed or found, such as a salt flat . . . especially a salt encrusted *playa* (p. 568[4]).

sand: A rock or mineral fragment having a diameter in the range of 0.062 to 2 mm; an unconsolidated aggregate of dominantly sand-size *clastic* particles.

sandstone: A *sedimentary rock* containing dominantly sand-size *clastic* particles.

sanidine: A high temperature mineral of the alkali-feldspar group: $(K,Na)(AlSi)_4O_8$. It is a highly disordered monoclinic form, occurring in clear, glassy, often tabular crystals imbedded in unaltered acid volcanic rocks such as trachyte [or rhyolite]; . . . (p. 572[4]).

saturated zone: A region of the subsurface where pores are completely filled with water; it is bounded at the top by the water table (p. 287[2a]).

scoria: Vesicular, cindery, crust on the surface of andesitic or basaltic lava, the vesicular nature of which is due to the escape of volcanic gases before solidification; it is usually heavier, darker, and more crystalline than pumice. (syn. cinder)

sediment: Solid *clastic* 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. Sedimentary deposits in a broad sense also include materials precipitated from solution or emplaced by explosive volcanism, as well as organic remains (e.g., peat) that have not been subject to appreciable transport.

sedimentary rock: A consolidated deposit of *clastic* particles, chemical precipitates and 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*, glacial drift, and eolian, *lacustrine* and marine deposits (e.g., *sandstone*, siltstone, *mudstone,* claystone, *shale, conglomerate*, *limestone, and dolomite)*.

shale: A *sedimentary rock* formed by induration of a clay or silty clay deposit and having the tendency to split into thin layers (i.e., fissility).

shapefile: A shapefile is a simple, nontopological format for storing the geometric location and attribute information of geographic features. Geographic features in a shapefile can be represented by points, lines, or polygons (areas). The workspace containing shapefiles may also contain dBASE tables, which can store additional attributes that can be joined to a shapefile's features.

sierra: A high range of mountains or hills, especially one having jagged or irregular peaks that when projected against the sky resemble the teeth of a saw (p. 599[4]).

silicic: A silica-rich igneous rock or magma. . . . [The] amount of silica is usually . . . at least two-thirds of the rock. In addition to the confined silica in feldspars, silicic rocks generally contain free silica in the form of quartz. Granite and rhyolite are typical silicic rocks (p. 599[4]). (*cf. felsic, mafic*)

silt: A rock or mineral fragment having a diameter in the range of 0.002 (μm) to 0.062 mm; an unconsolidated aggregate of dominantly silt-size particles.

sink (geog.): A depression containing a central playa or saline lake with no [surface] outlet, as where a desert stream comes to an end or disappears by evaporation (p. 599[4]). (*cf. endorheic*)

SI units: The International System of Units (SI, abbreviated from the French Système international (d'unités)) is the modern form of the metric system. . . . It comprises a coherent system of units of measurement starting with seven base units, which are the second (the unit of time with the symbol s), metre (length, m), kilogram (mass, kg), ampere (electric current, A), kelvin (thermodynamic temperature, K), mole (amount of substance, mol), and candela (luminous intensity, cd).

smectite: The accepted group name for 2:1 phyllosilicate clay minerals with layer charge between 0.2 and 0.6 formula unit which can take polar liquids into the interlayer space causing them to swell in a direction perpendicular to the 001surface, . . . (p. 607[4]).

static water level (swl): The water level of a well [below a surface measuring point] that is not being affected by the withdrawal of groundwater (p. 625[4]).

stratified: Arranged in layers or strata. The term refers to geologic material. Layers in soils that result from the processes of soil formation are called horizons.

stratigraphy: The branch of geology that deals with the definition and interpretation of stratified 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 of dating. The term is applied both to the sum of the characteristics listed and a study of these characteristics. (*cf. hydrostratigraphic unit*)

stream terrace: One of a series of relatively flat surfaces bordering a stream valley, and more or less parallel to the stream channel; originally formed near the level of the stream, and representing the dissected remnants of an abandoned *flood plain*, stream bed, or *valley* floor produced during a former stage of erosion or deposition. Erosional surfaces cut on *bedrock* and thinly mantled with stream deposits (alluvium) are designated "strath terraces." Remnants of *constructional* valley floors are termed "alluvial terraces." The term is applied to both the relatively flat summit surface (platform, tread), which is cut or built by stream action, and the steeper descending slope (scarp), graded to lower *base levels* of erosion. (*cf.* terrace, valley-border surfaces)

tableland: A general term for a broad upland mass with nearly level or undulating *summit* area of large extent and steep sideslopes descending to surrounding lowlands. Varieties include *plateaus* and *mesas*.

tectonics: A branch of geology dealing with the broad architecture or outer part of the Earth, that is the regional assembling of structural or deformational features in studies of their mutual relationships, origin, and evolution (p. 659[4]).

tephra: A collective term for all *clastic volcanic* materials that are ejected from a vent during an eruption and transported through the air, including volcanic *ash,* cinders, lapilli, *scoria, pumice,* bombs, and blocks. (syn. volcanic ejecta)

terrace (geomorphic): A step-like surface, bordering a valley floor or shoreline, that represents, the former position of an alluvial plain, or lake or sea shore. (*cf. stream terrace*)

terrain (geog.): A tract or region of the Earth's surface considered as a physical feature, [or] an ecological environment . . . (p. 663[4]).

terrane (geol.): A fault-bounded body of rock of regional extent, characterized by a geologic history different from that of contiguous terranes . . . Informally, a region where a particular rock or group of rocks predominates (p. 663[4]).

Tertiary: The first period of the *Cenozoic* Era of geologic time, which is followed by the *Quaternary* Period and has age range of about 2.6 to 65.5 Ma, and is preceded by the *Cretaceous* Period of the *Mesozoic* Era (65.5-251 Ma)[5]. "*Tertiary*" is also used to designate the corresponding time-stratigraphic subdivision (Systems) of earth materials, and it is subdivided into the *Pliocene* (2.6-5.3 Ma), *Miocene* (5.3-23 Ma), *Oligocene* (23-34.9 Ma), *Eocene* (34.9-55.8 Ma), and *Paleocene* (55.8-65.5 Ma) Epochs/Series. Informal *Upper*, *Middle*, *Lower Tertiary* time/rock units, respectively, comprise the *Pliocene-Miocene*, *Oligocene*, and *Eocene-Paleocene* Epochs/Series.

Thenardite: A white or brownish orthorhombic mineral: Na_2SO_4. It occurs in masses or crust, often in connection with saline/alkali lakes (p. 666[4]).

topography: The relative positions and elevations of the natural features of an area that describe the configuration of its surface.

transpression: A system of Earth-crustal stresses that tends to cause oblique shortening; e.g., combined reverse and strike-slip fault deformation.

tuff: Consolidated or cemented volcanic ash and lapilli (p. 688[4]).

tuff ring: Pyroclastic deposits having low-angle (2°-10°) outer slopes that surround a wide crater that may be a maar (p. 689[4]).

unconfined aquifer: A permeable formation whose upper boundary is the *water table* (p. 291[2a]).

underflow: (1) Movement of groundwater in an underflow conduit (Meinzer 1923, p. 43).

underflow: (2) The term has been used in a broader sense in the "Central Alluvial Basins" of the American Southwest; e.g., "Underflow, however, may be a large part of total recharge in the more arid basins of western Arizona (Anderson et al. 1988, p. 83, Fig. 2).

underflow conduit: An underflow conduit [that] consists of a permeable deposit, which underlies a surface streamway, is more or less definitely limited at its bottom and sides by rocks of relatively low permeability, and contains groundwater and percolates approximately downstream (Meinzer 1923, p. 43-44; Slichter 1905, Fig. 2).

vadose zone (preferred here) or unsaturated zone: The zone in soils or rocks between the Earth's surface and the *water table*; pores are partly filled with water and partly filled with air (p. 291[2a,b]).

valley: Any low-lying land bordered by higher ground; especially an elongate, gently sloping depression of the Earth's surface, . . . It is usually developed by stream erosion (p. 701[4]).

valley-border surfaces: A general grouping of valley-side surfaces (e.g., *stream terraces* or dissected alluvial fans) that occur in a stepped sequence graded to successively lower stream base levels produced by episodic valley entrenchment.

valley fill: The unconsolidated sediment deposited by any agent (water, wind, ice, mass wasting) so as to fill or partly till a stream valley. (*cf. alluvium*, *basin fill*)

valley floor: A general term for the nearly level to gently sloping, bottom surface of a valley. Component landforms include axial stream channels, the *floodplain*, and in some areas, low *terrace* surfaces that may be subject to flooding from tributary streams. (*cf.* floodplain landforms, meander, braided channel, valley side).

vertisols: Mineral soils that have 30% or more clay, deep wide cracks when dry, and either gilgai microrelief, intersecting slickensides, or wedge-shaped structural aggregates tilted at an angle to the horizon. An order in the U.S. system of soil taxonomy (p. 706[4]).

volcanic: Pertaining to (1) 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 (2) the structures, rocks, and landforms produced.

volcaniclastic: Pertaining to the entire spectrum of fragmental materials with a preponderance of clasts of *volcanic* origin. The term refers not only to *pyroclastic* materials but also to *epiclastic* deposits derived from volcanic source areas by normal processes of mass wasting and stream *erosion.*

voxel: Each of an array of elements of volume that constitute a notional three-dimensional space that is used in computer-based modeling or graphic simulation.

water gap: A deep pass in a mountain ridge through which a stream flows (p. 715[4]). (*cf. wind gap*)

water table: A pressure where the pressure head is zero in a gauge-pressure sense (i.e., atmospheric pressure). Geologic media below the water table are generally considered fully saturated and the water below is under positive pressure. Additionally, because capillary forces in the vadose zone above the water table, the portion of the media slightly above the water table is almost fully saturated and under negative pressure. This portion of the media is generally called the *capillary fringe* (p. 151[2b]).

wind gap: A former *water gap*, now abandoned by the stream that formed it; a *pass* that is not occupied by a stream (p. 723[4]).

xenolith: A fragment of country rock within a plutonic or volcanic rock (p. 727[4]).

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New Mexico Water Resources Research Institute
3170 S. Espina Street
New Mexico State University
Las Cruces, NM 88003-8001

(575) 646-4337 • nmwrri@nmsu.edu