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Speleology, Caves, Speleothem

Cave

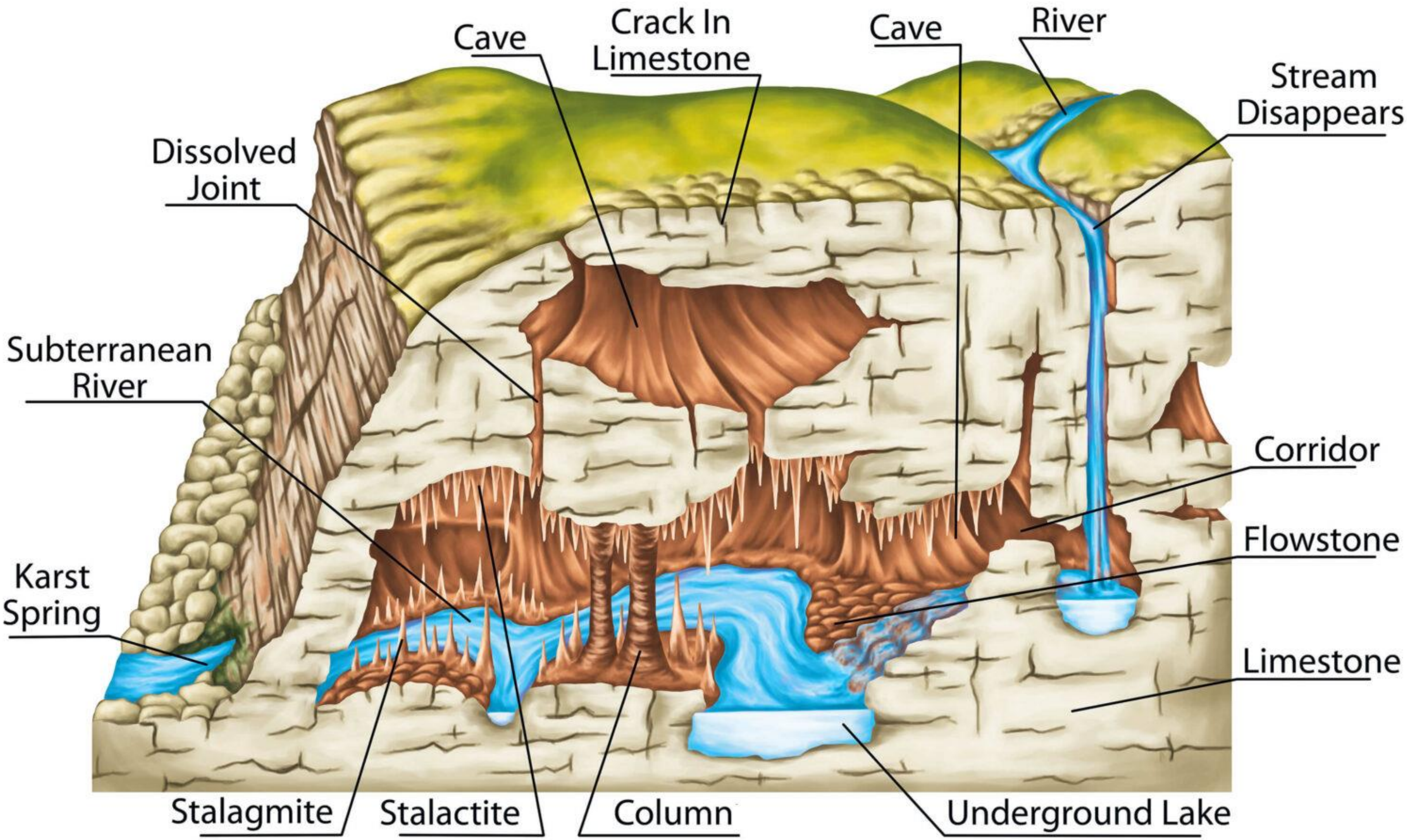
A cave is a natural cavity in a rock which acts as a conduit for water flow between input points, such as streamsinks, and output points, such as springs or seeps (White 1984).

A simpler, non-scientific definition would be that caves are natural cavities in a rock which are enterable by people. This implies a minimum size of about 0.3m diameter.

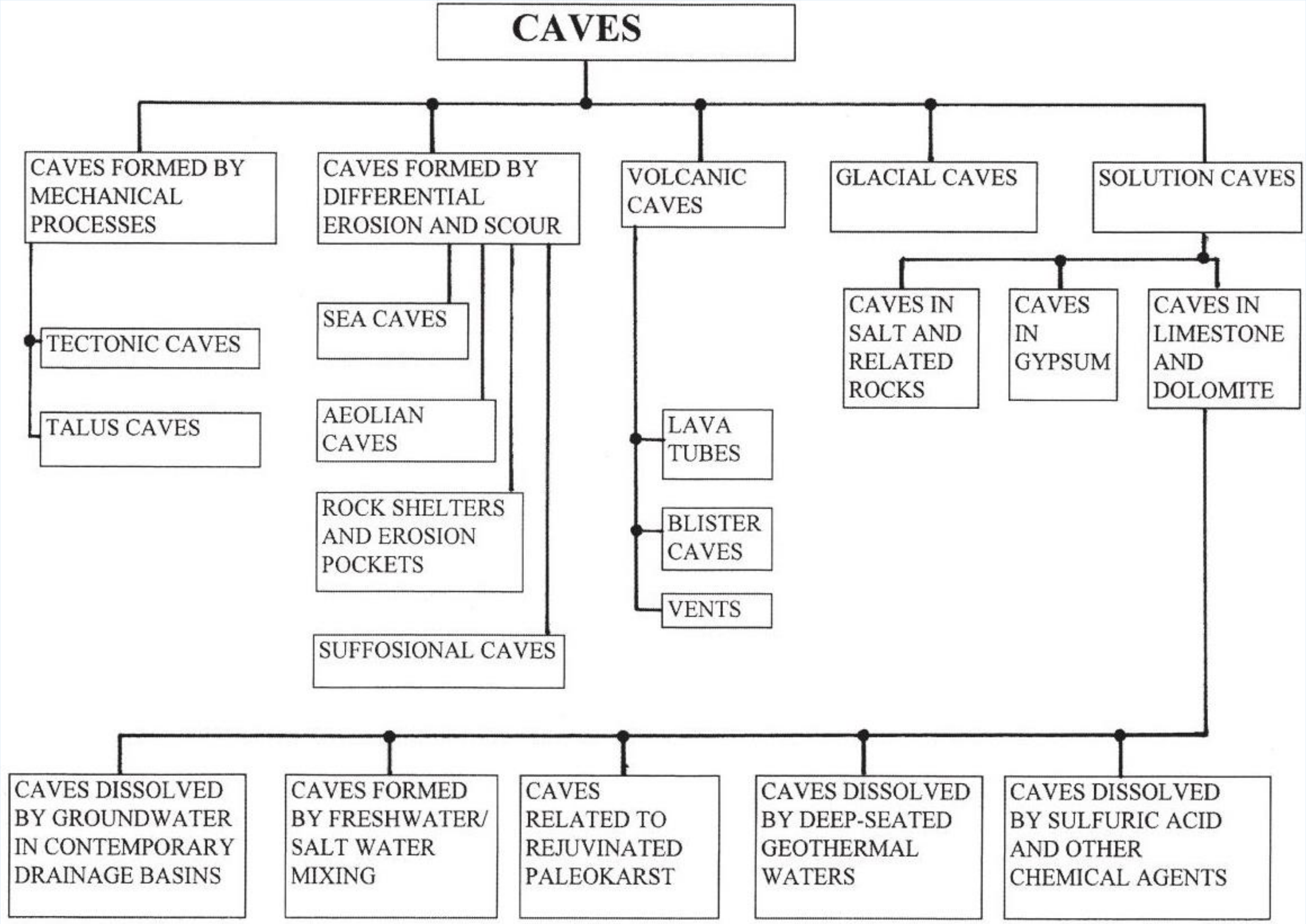
İn
Düden
Subatan
Obruk
Kestel
Zindan
Delik
Kehf

Natural Caves

https://nckri.org/caves/types/



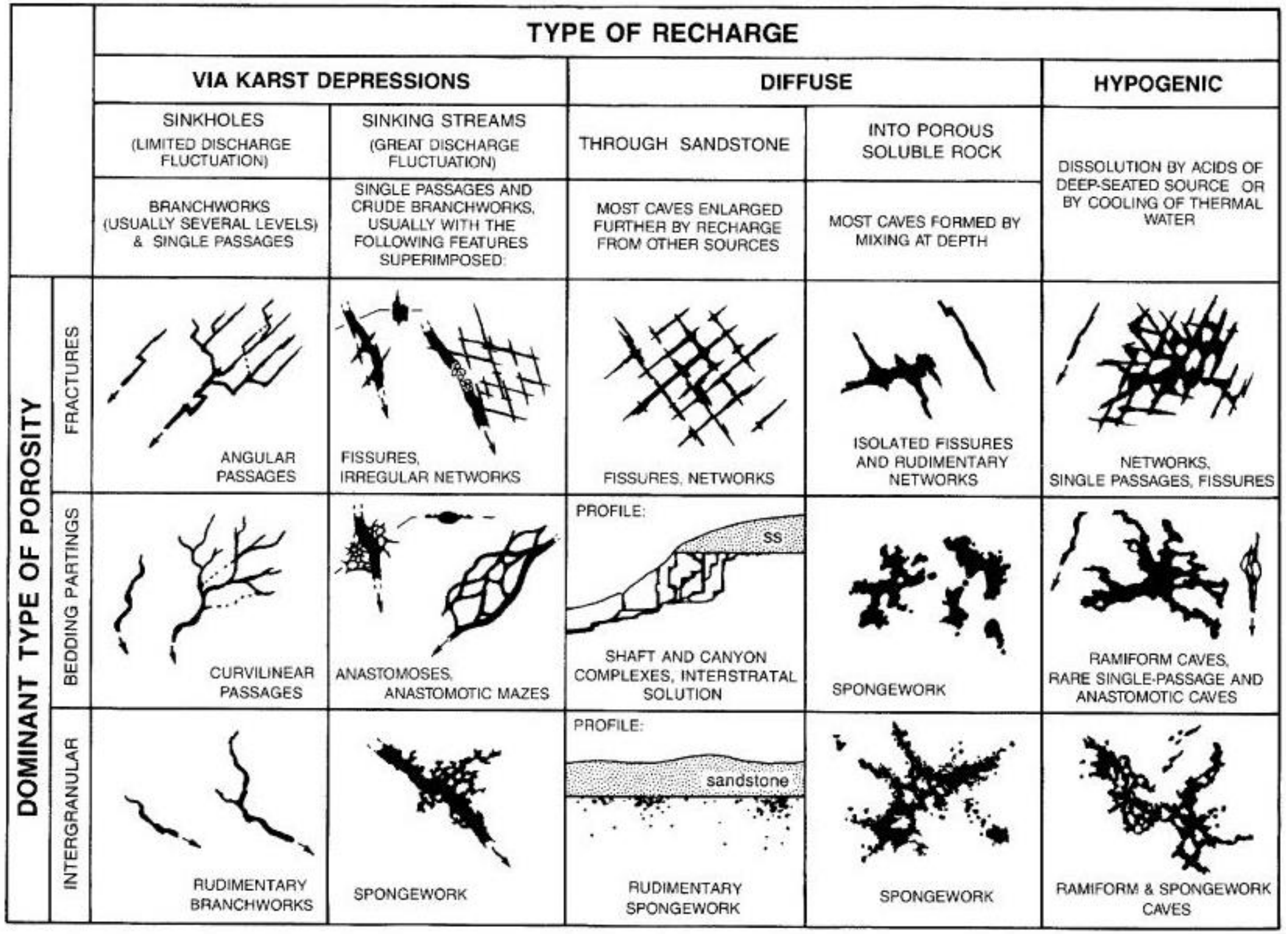
Types of caves



Culver, D.C., White, W.B. 2004. Encylopedia of caves. Elsevier.

Cave passages

The distribution and geometry of passages within a cave are influenced by a combination of local geological, structural, and hydrological factors. Variations in the solubility of different rock layers can determine the specific strata in which a passage develops. Interbedded rocks with very low solubility, such as shales, clays, or chert, can trap groundwater and create passages at the base of more soluble rock groups. Fractures that cut through these less soluble layers allow the formation of pits that can extend down to the next low-solubility layer, creating a stairstep pattern. Passages formed along fractures tend to be narrow and straight, often featuring sharp, right-angle turns and intersections with other passages.



Summary of cave patterns and their relationship to types of recharge and porosity. *From Palmer, 1991. Used*

Culver, D.C., White, W.B. 2012. Encylopedia of caves, 2nd edition. Elsevier.

Cave

Vadose canyons

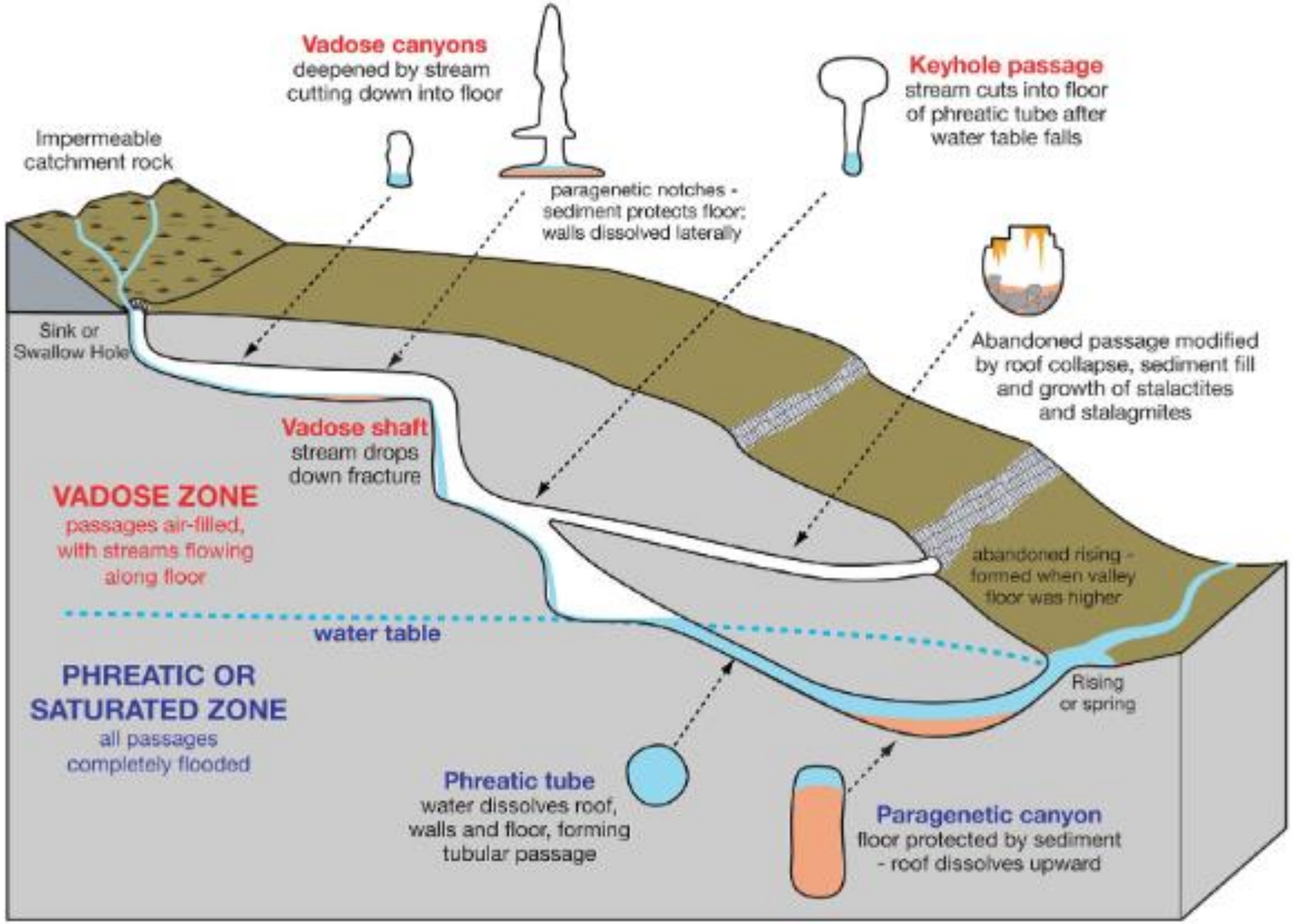
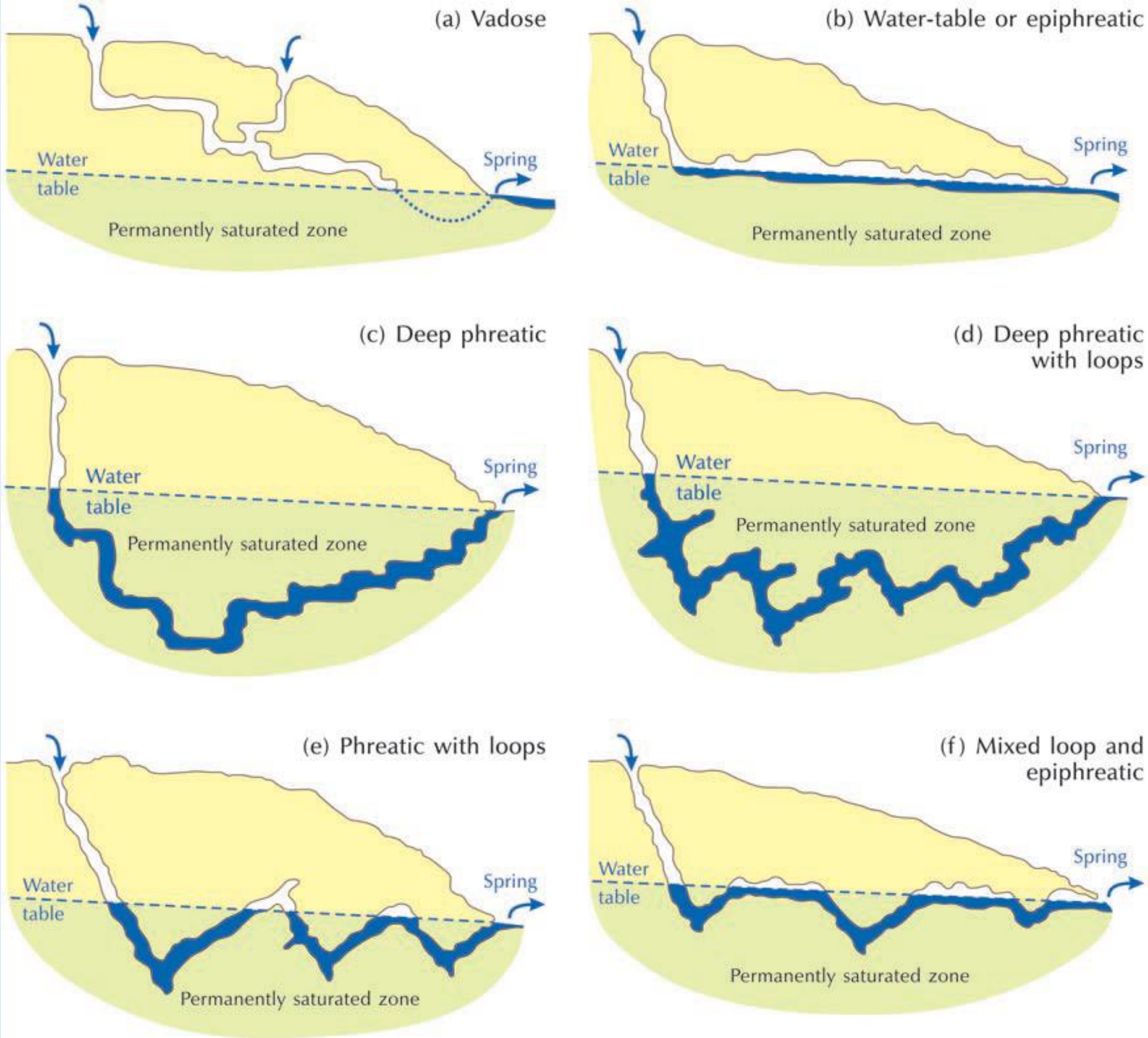


Figure 8 Diagrammatic section through a cave system to show the various features discussed in the text.

Simms, M.J. 2014. Karst and Paleokarst, In Sedimentary Processes, Encyclopedia of Geology.

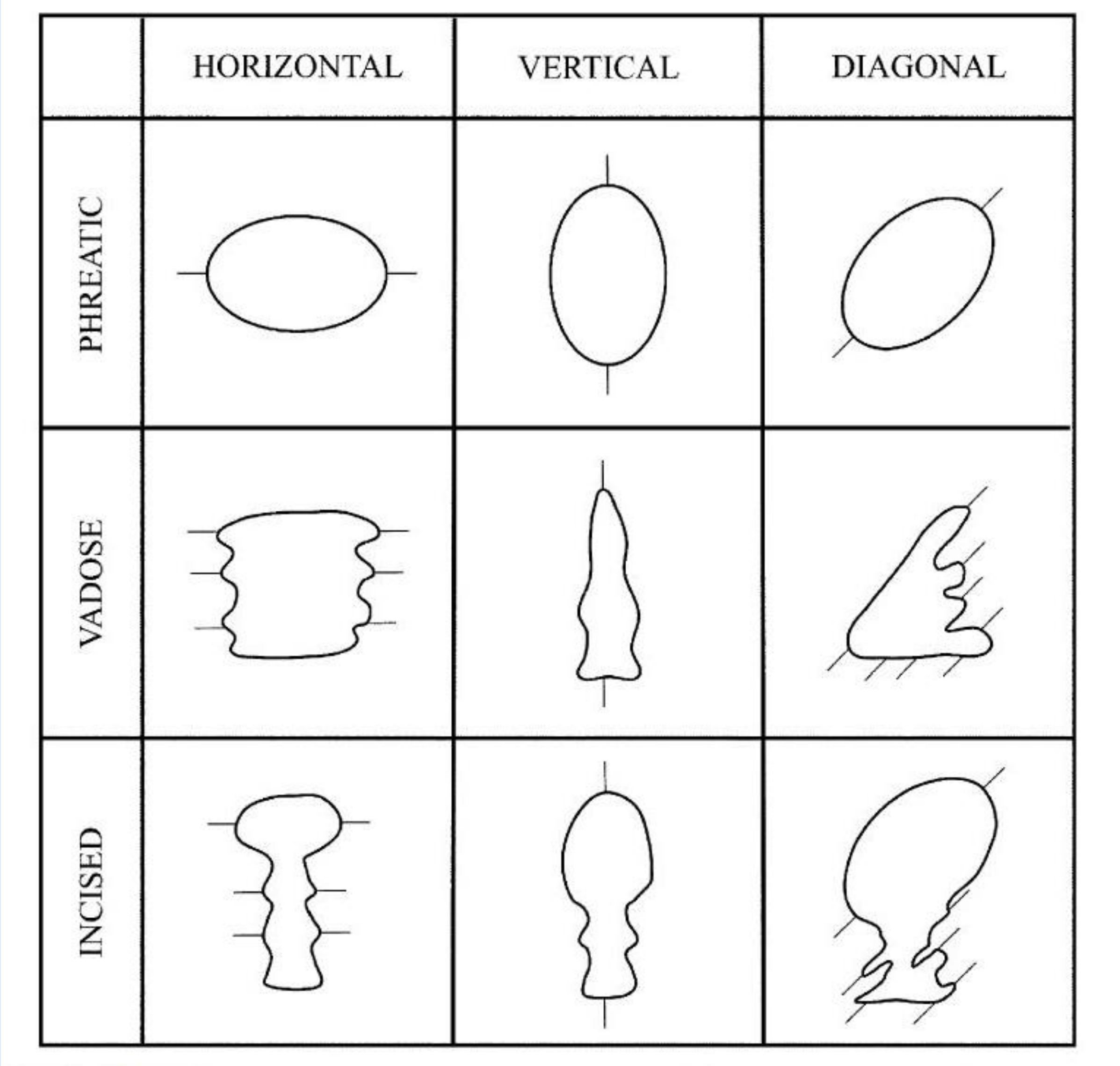
Types of Caves



Hugget, R.J. 2011. Fundamentasl of Geomorphology. Routledge.

Cave passages

Phreatically formed passages have cross sections that are circular to elliptical. The orientation of these ellipses-vertical, horizontal, or diagonal-depends on whether the passage expands along a fracture or bedding plane, and the direction of these features. Phreatic walls are typically smooth, and the symmetry of these passages results from their development below the water table, where water pressure is evenly distributed on all walls.



Culver, D.C., White, W.B. 2012. Encylopedia of caves, 2nd edition. Elsevier.

Speleology, Caves, Speleothem

Phreatic tube

http://www.winstercavers.org.uk/PhotoGallery.aspx?PhotoID=193

http://www.dudleycavingclub.org.uk/phreatic_tubes.htm

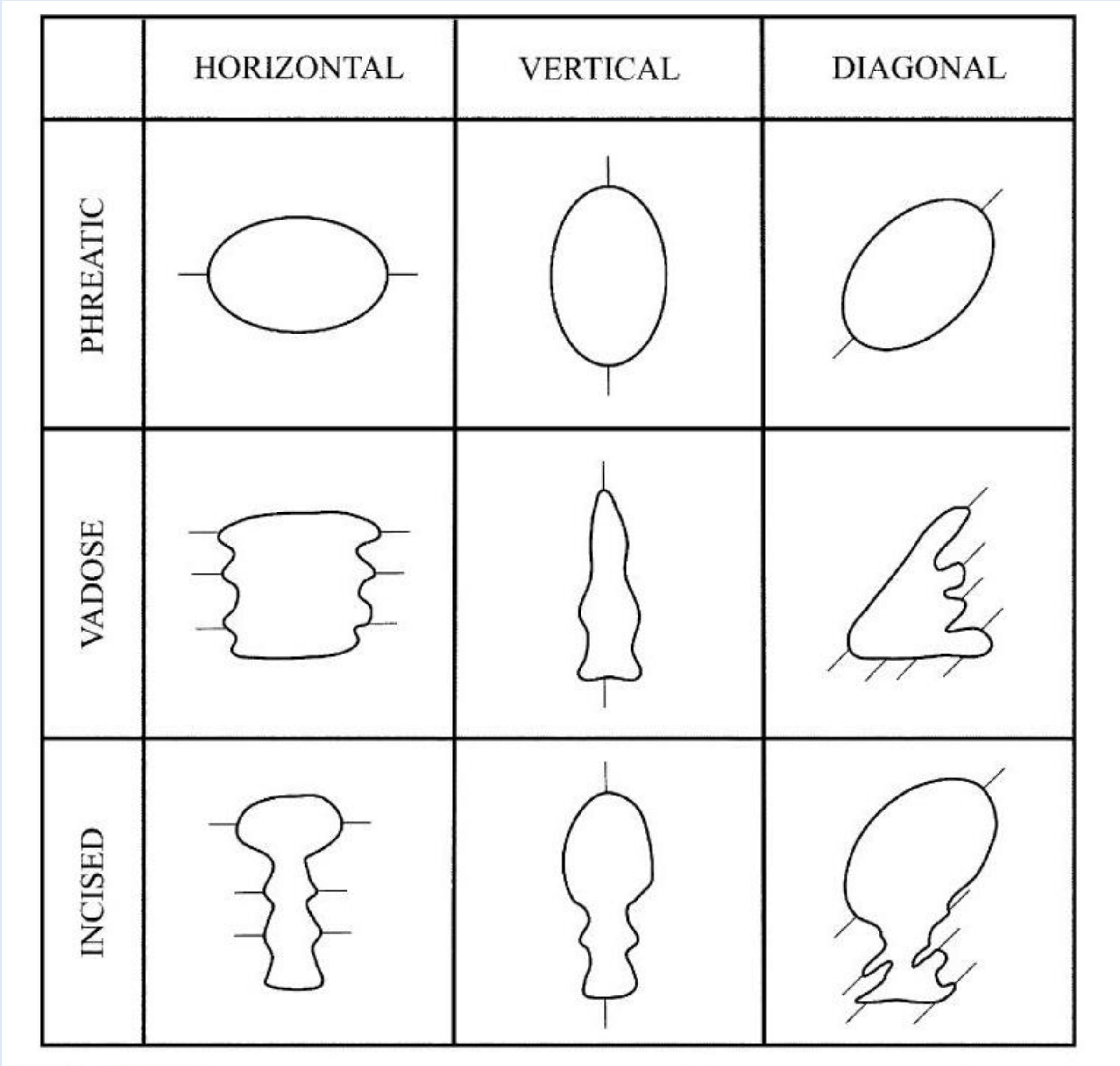
Speleology, Caves, Speleothem

Phreatic tube

scallops

Cave passages

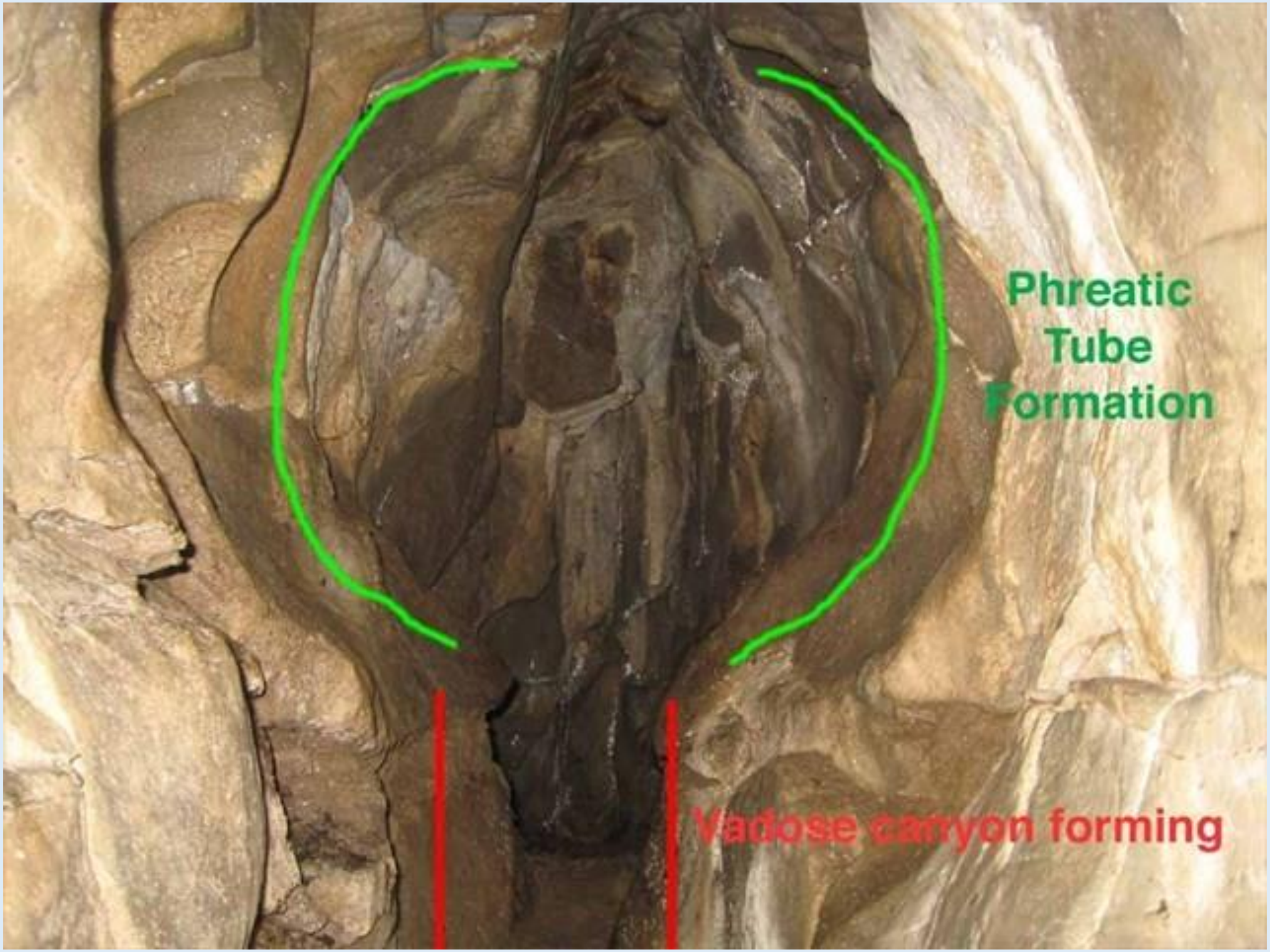
Vadose passages, relatively tall and narrow in cross section, particularly where the hydraulic gradient is steep or the bedding is thick. These passages are formed by vadose water eroding the **floor** as it flows downward to reach the water table as directly as possible. The pressure and dissolution effects are focused on the floors and lower walls. Pits represent the ultimate form of vadose passage. The walls of vadose passages are often rough and irregular due to increased turbulence, varying water pressure, dissolution differences, and mechanical erosion from rocks and other sediments carried by the water. Passages along vertical fractures are usually narrow, while those along horizontal or dipping fractures and beds are wider, as these orientations facilitate undercutting, collapsing, dissolving, and washing away of the strata.



Culver, D.C., White, W.B. 2012. Encylopedia of caves, 2nd edition. Elsevier.

Vadose canyons

Keyhole passage



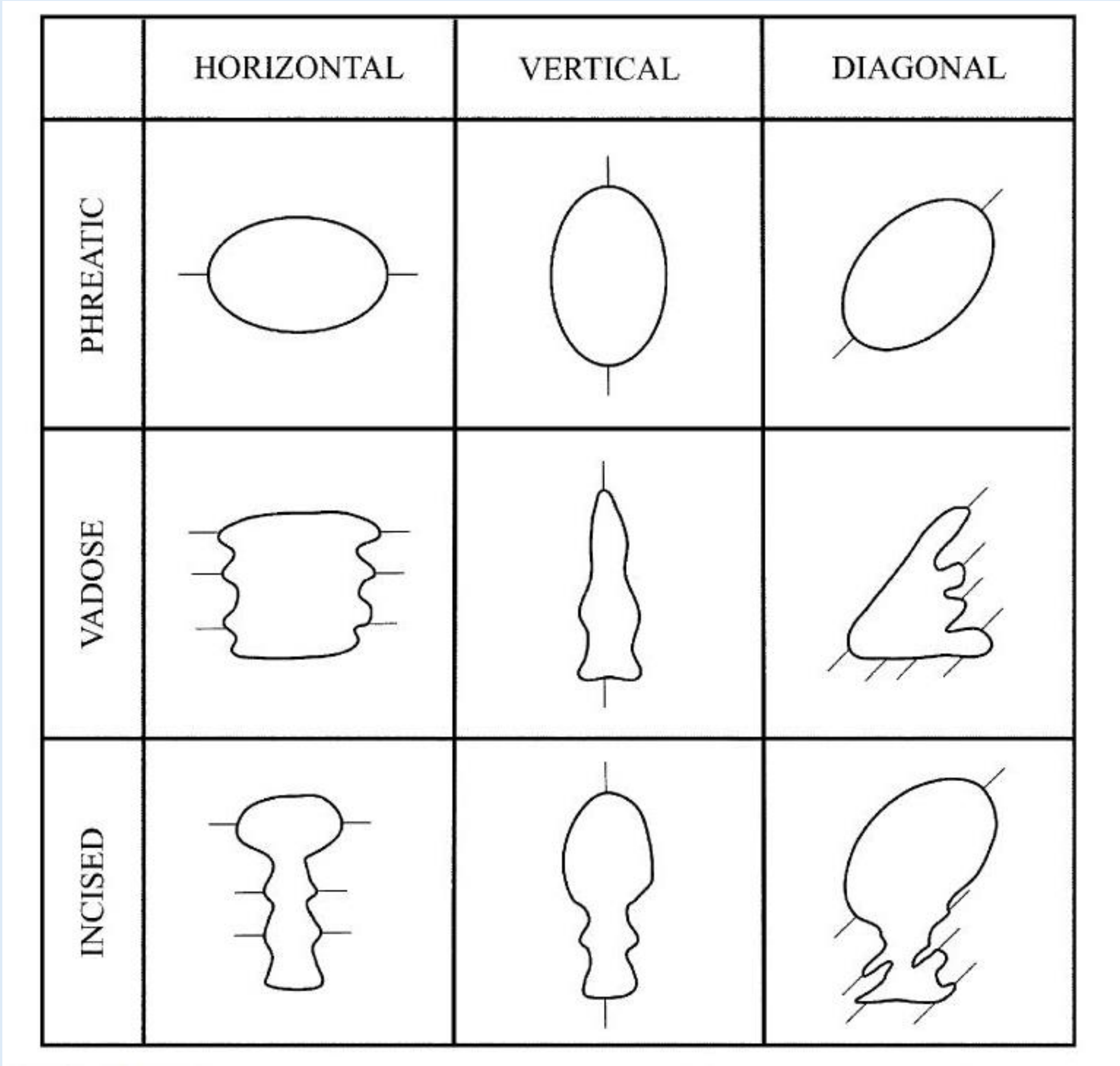
https://www.geocaching.com/geocache/GC61BHC

Speleology, Caves, Speleothem

Vadose canyons

Cave passages

As the land surface erodes over time, water levels in an aquifer naturally decline, allowing groundwater to discharge from progressively lower elevations. This causes phreatic passages to often drain and become modified under new vadose hydrologic conditions. The most common change is the incision of passage floors to drain water to the lowering water table, resulting in keyhole-shaped passages where a broad, smooth-walled phreatic tube sits above a narrow, rough-walled vadose canyon. In caves where phreatic water moved up and down pits, newly formed vadose passages at the tops of pits can create waterfalls, which extend the pit by eroding headward toward the water source into the wall below the passage.



Culver, D.C., White, W.B. 2012. Encylopedia of caves, 2nd edition. Elsevier.

Speleology, Caves, Speleothem

Vadose canyons

Keyhole passage

Speleology, Caves, Speleothem

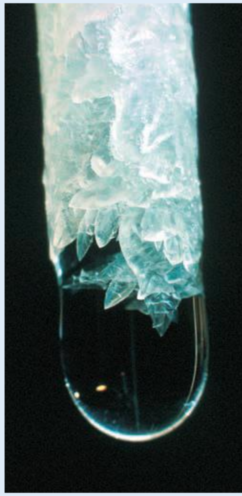
Vadose canyons

Keyhole passage

Speleothem

Speleothems are secondary mineral deposits, which are formed in caves through the action of **flowing**, **dripping**, **ponded**, or **seeping** water. The most commonly consisting primarily of minerals such as calcite, aragonite, and gypsum, although other minerals may also be present in smaller quantities. The shapes of these formations are influenced by the interplay between water dynamics and the crystal growth patterns of the minerals involved. For instance, **stalactites**, **stalagmites**, **flowstone**, and similar formations resulting from dripping or flowing water are shaped by the specific behavior of the water flow, while helictites, anthodites, gypsum flowers, and pool deposits formed through seeping water conform to the crystal growth patterns. The tan, orange, and brown hues commonly observed in calcite speleothems, as well as their luminescence under ultraviolet light, can be attributed to the presence of humic and fulvic acid from the soils above. Speleothems are not exclusive to water-formed caves; they can also be found in lava tubes.

Speleothem



Stalactites

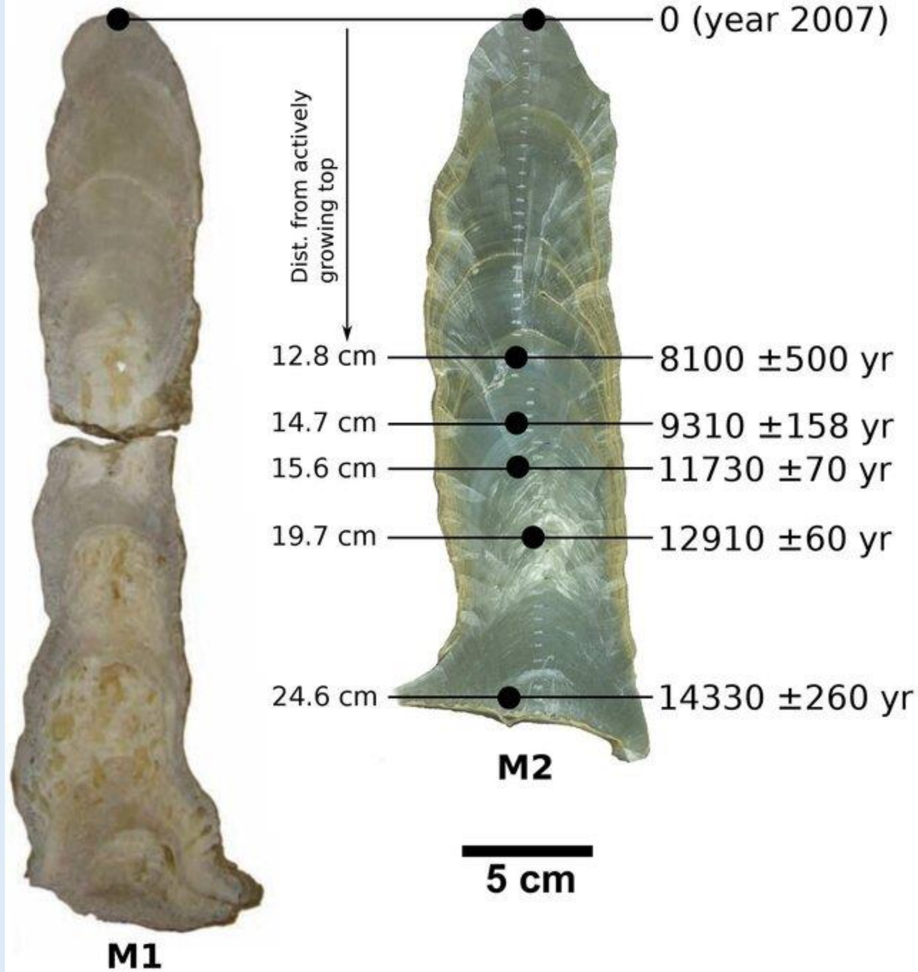
Stalactites, hanging from cave ceilings, often possess a hollow center, with growth occurring around this central opening, while stalagmites, forming incrementally at drip sites, are typically solid. Consequently, stalagmites are preferred for paleoclimatic analysis. Comprised primarily of calcium carbonate, speleothems result from groundwater percolating through surrounding carbonate rock. Traces of certain elements may imbue the deposits with distinctive colors, with uranium serving as a tool for determining their age. Seasonal variations in trace element composition in drip waters can aid in identifying annual layers. Deposition occurs through water evaporation or carbon dioxide degassing from water droplets. Evaporation is significant mainly near cave entrances; hence, speleothems found deep within caves primarily form through degassing. Water percolating through soil, enriched with carbon dioxide from decaying organic matter, becomes supersaturated upon entering the cave, leading to calcite precipitation through carbon dioxide degassing.

Speleothem

Paleoclimate records from Speleothems

Stalagmites exhibit various physical and chemical properties that can be utilized to reconstruct historical climate records, with stable isotopes of oxygen and carbon being the most commonly used indicators. While oxygen isotope values were once considered reliable indicators of temperature, they are now primarily used to indicate moisture sources or rainfall amounts. Carbon isotopes, on the other hand, reflect changes in vegetation, soil conditions, and aridity.

https://railsback.org/speleoatlas/SAimage0004.html



Spadin, F., Marti, D., Hidalgo-Staub, R., Rička, J., Fleitmann, D., Frenz, M., 2015. Technical Note: How accurate can stalagmite formation temperatures be determined using vapour bubble radius measurements in fluid inclusions? Clim. Past 11, 905-913.

Speleothem

Speleothem

Speleothem

Speleothem

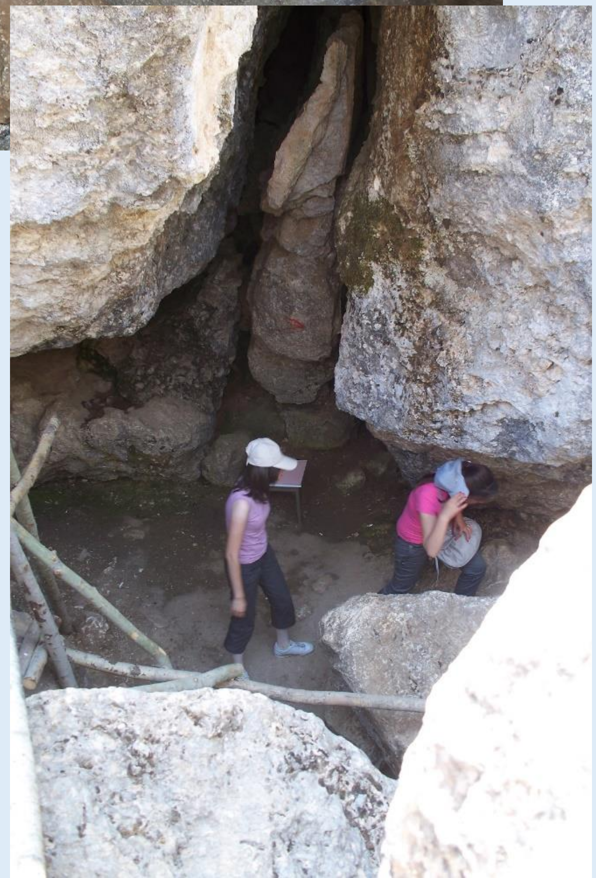
Speleothem

Speleothem

Speleothem

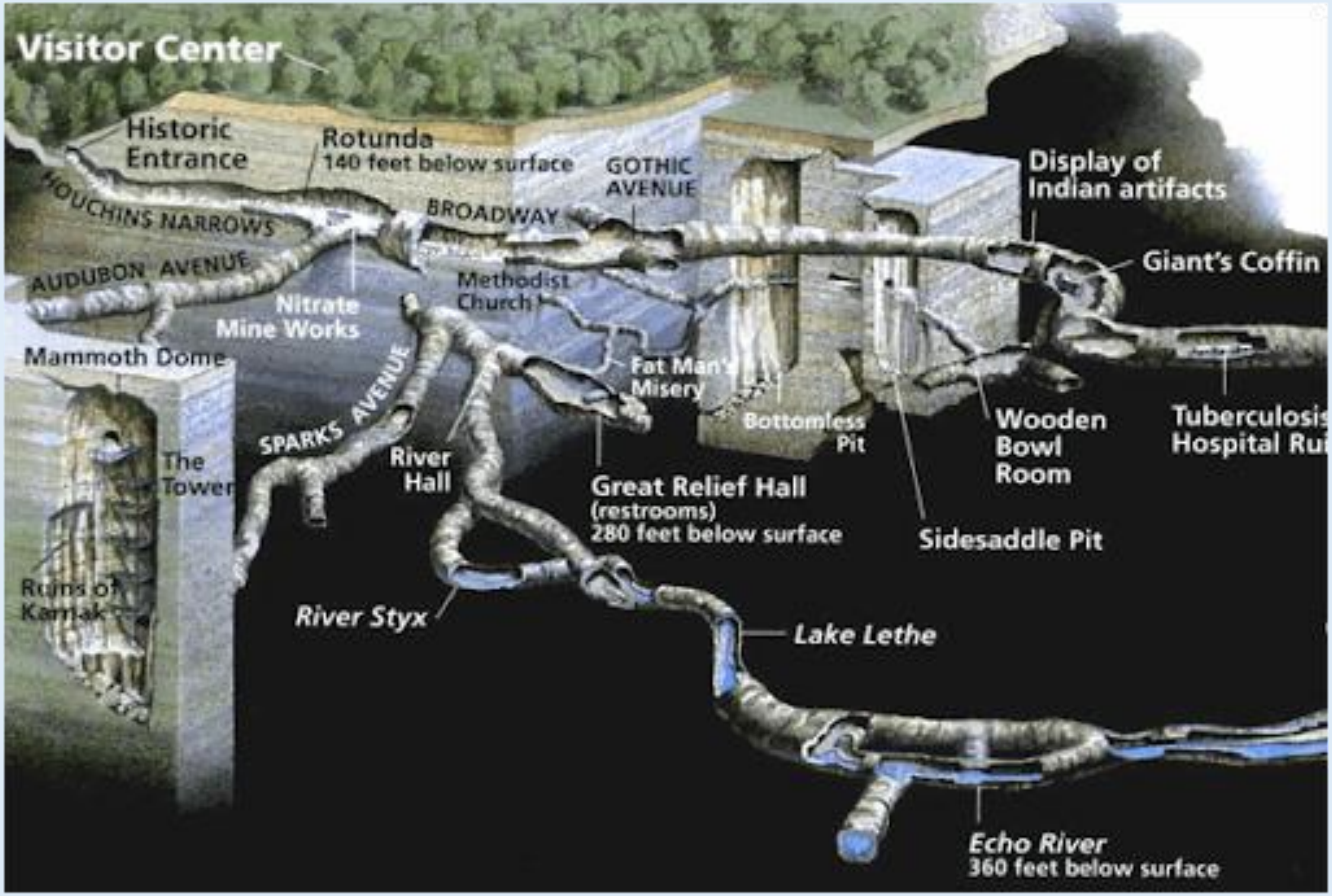
Speleology, Caves, Speleothem

Buzluk Mağarası



Speleology, Caves, Speleothem

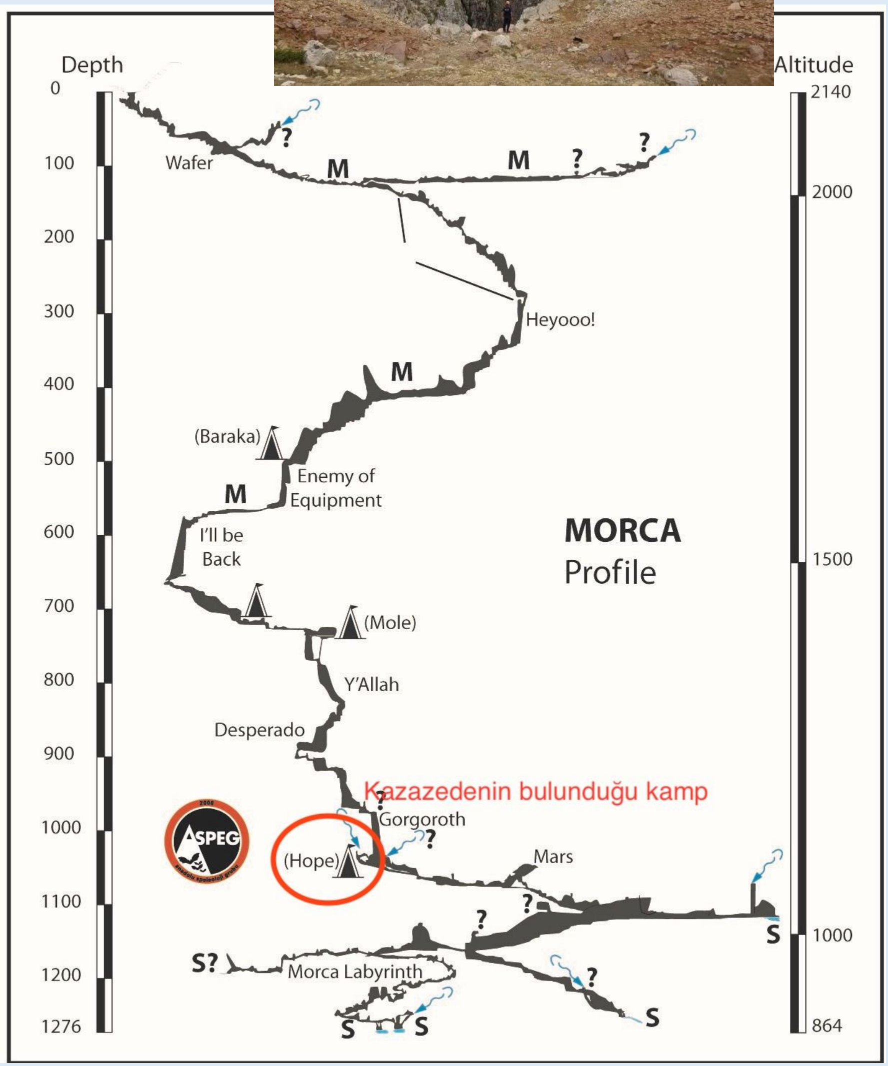
Mammoth cave system

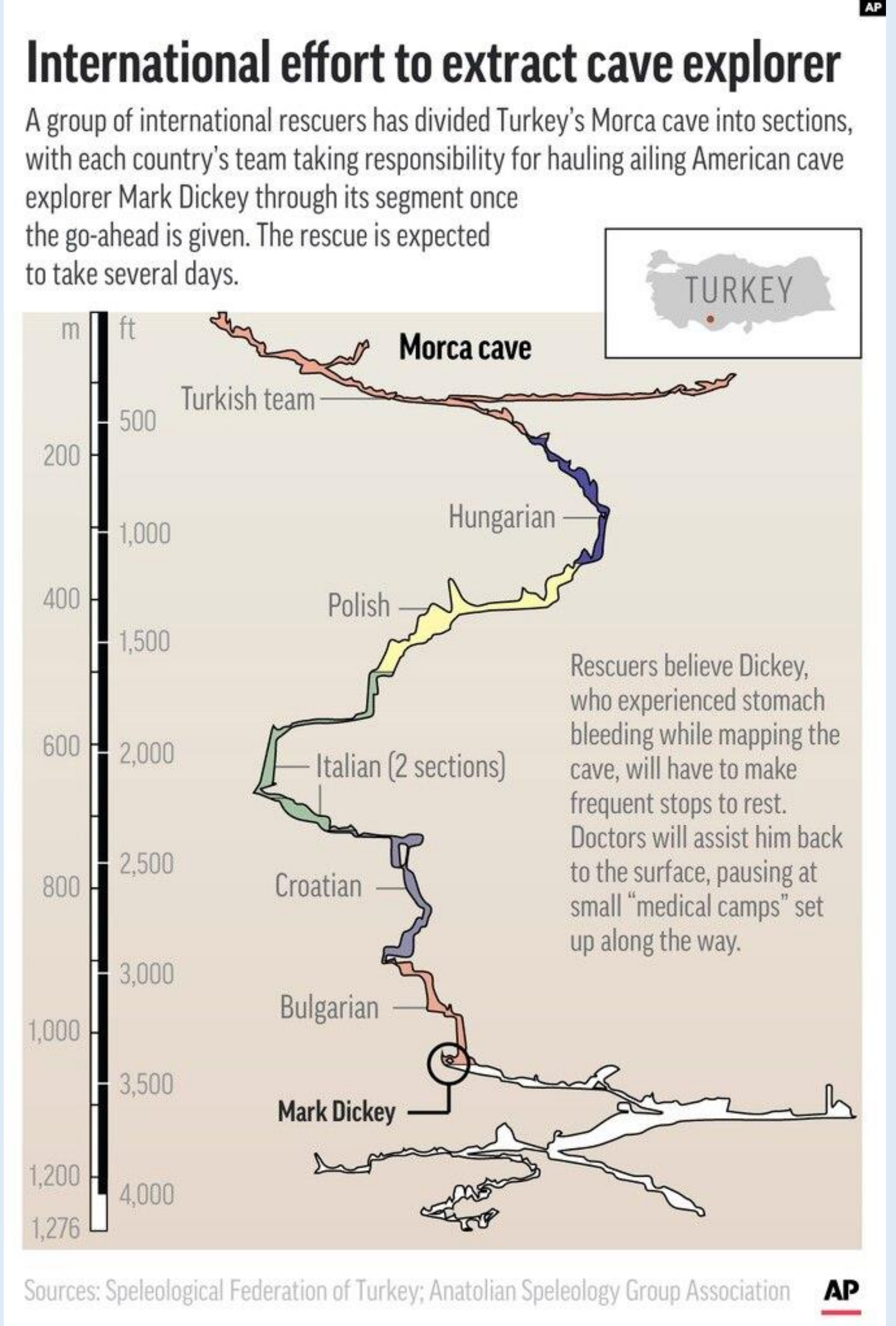


http://www.jsjgeology.net/Rotunda.htm

Speleology, Caves, Speleothem

Morca cave





https://www.voanews.com/a/rescue-of-american-caver-begins-in-turkey-/7261738.html

PSEUDOKARST

Evacuation of molten rock (basalt)	*: Volcanoes*
Evacuation of melt water (ice)	*: Glacier caves*
Dissolution and granular disintegration (soil)	*: Soil pipes ..*
Hydraulic plucking (most rock, some exsudation)	*: Sea caves ….*
Tectonic movements (most rock)	*: Fault fissures*
Granular disintegration and wind transport (sandstones)	*: Rock shelters …….*
Granular disintegration aided by seepage moisture (especially granular lithologies)	*: Tafoni, rock shelters and boulder caves*

Gillieson, D. 1996. Caves: Processes, Development and Management, Blackwell

Glaciokarst

Glaciokarst

Glaciokarst