Desert Pavements and Vesicular Horizons

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Desert Pavements & Vesicular Horizons:

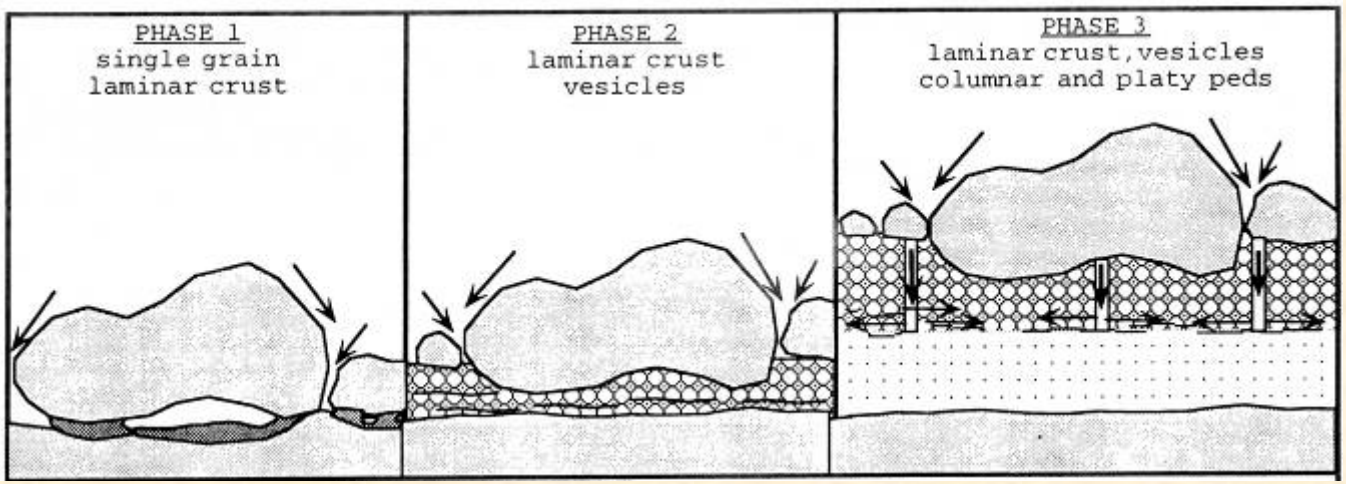
- What are they?
- Where do they occur?
- How do they form?
- What is their ecological significance?

Desert pavement

- Surface feature in deserts.
- Closely fitted, single layer of clasts.

Rough surface of desert pavement traps dust

Dust moves beneath clasts, lifts them up



Vesicular horizons

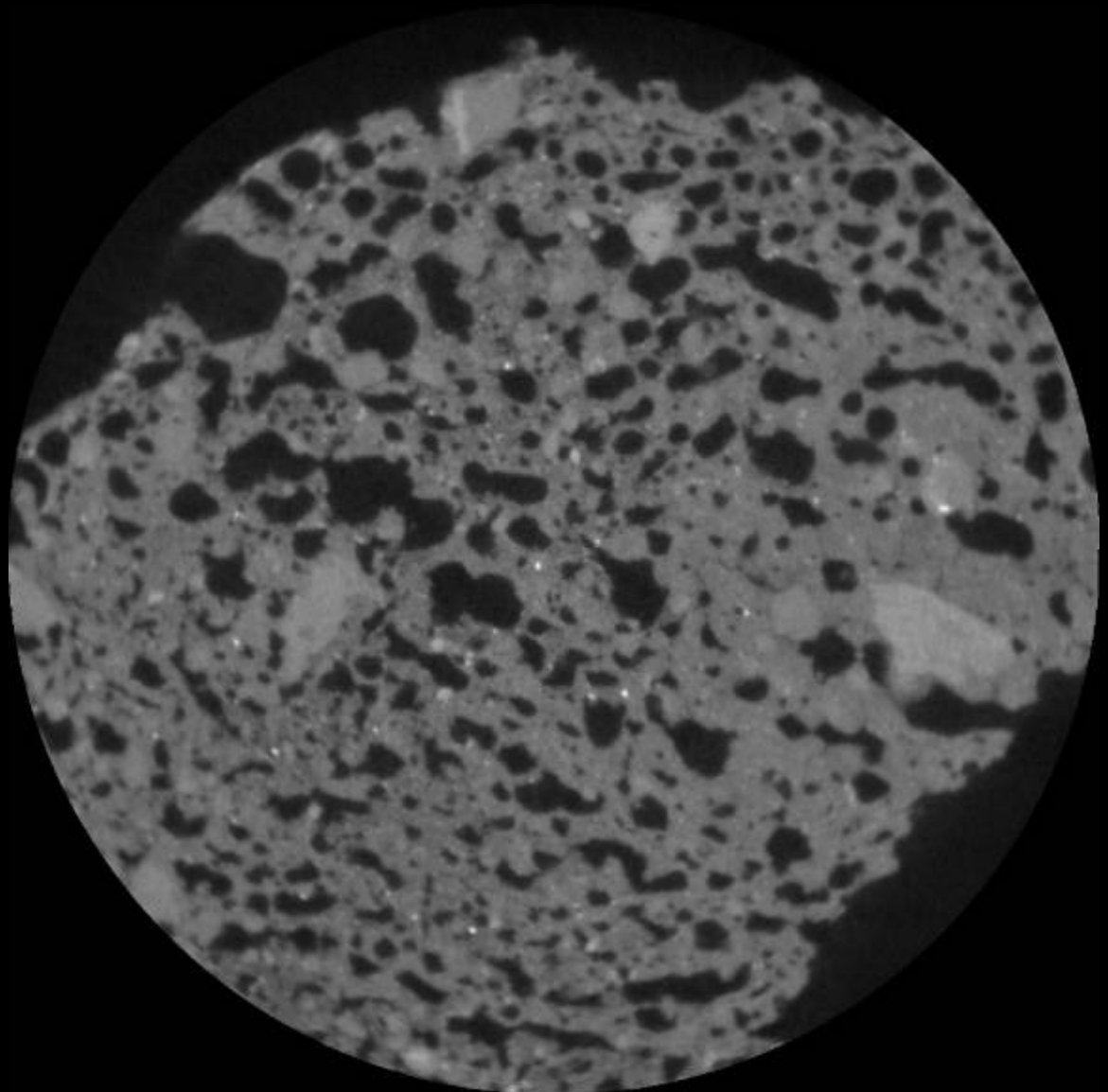
- Occur at or near the surface.
- Contain abundant vesicular pores.
- Platy structure or massive.
- Often 3-10 cm thick.

The vesicular A horizon (“Av”)

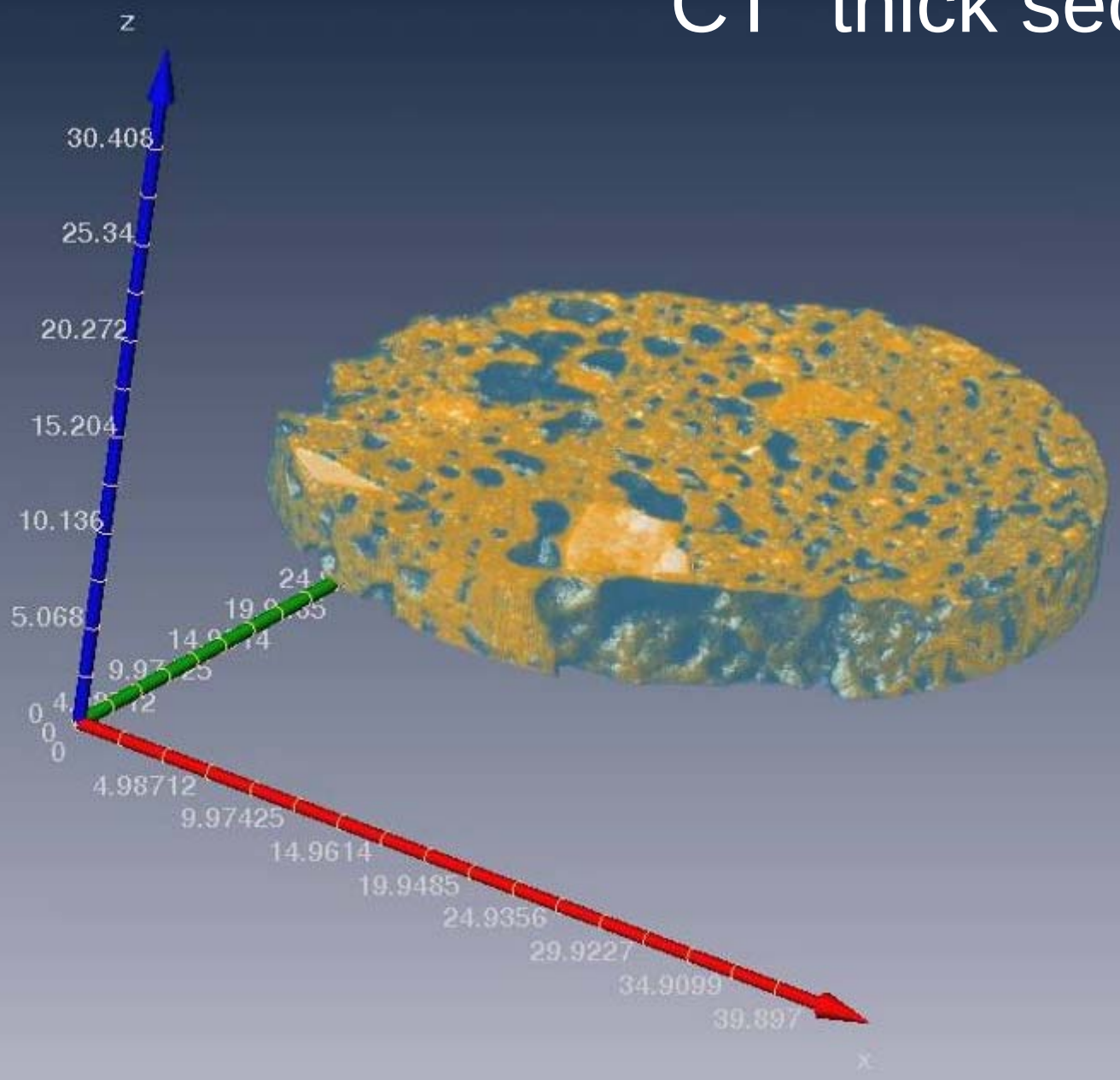
Springer, 1958. *SSSA Proc.*

Horizon	*Depth inches*	*Description*
Desert pavement	1-0	Varnished slabby desert pavement of olivine basalt covers 90% of surface.
A_v	0-2.5	Pinkish gray (5YR 7/2D) very fine sandy loam with vesicular structure; harsh floury; boundary abrupt smooth. Vertically cracked into polygonal blocks of 3-inch cross section.
B_{21}	2.5-7	Reddish brown (5YR 5/4D) clay loam with strong medium granular and fine angular blocky structure; slightly hard. Upper ¼-inch is fine granular and friable. Boundary gradual, wavy. Basalt pebbles are bare. Horizon of maximum root development.
B_{22}	7-10	Light reddish brown (5YR 6/4D) clay loam with moderate medium granular and fine angular blocky structure; slightly hard. Boundary gradual, wavy. Some flat basalt rocks with tops bare and bottom covered with $CaCO_3$.

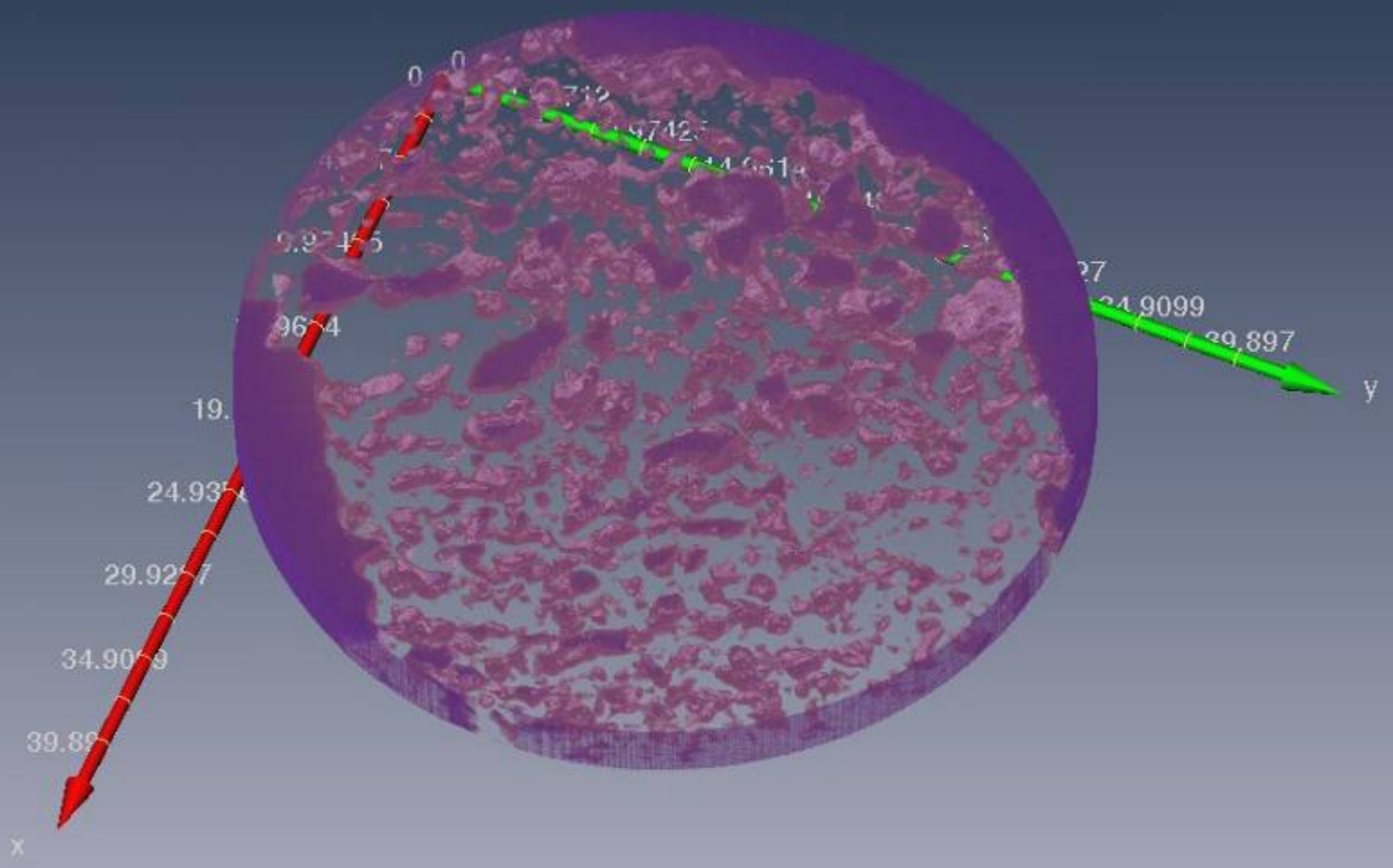
X-ray computed tomography of vesicular horizon



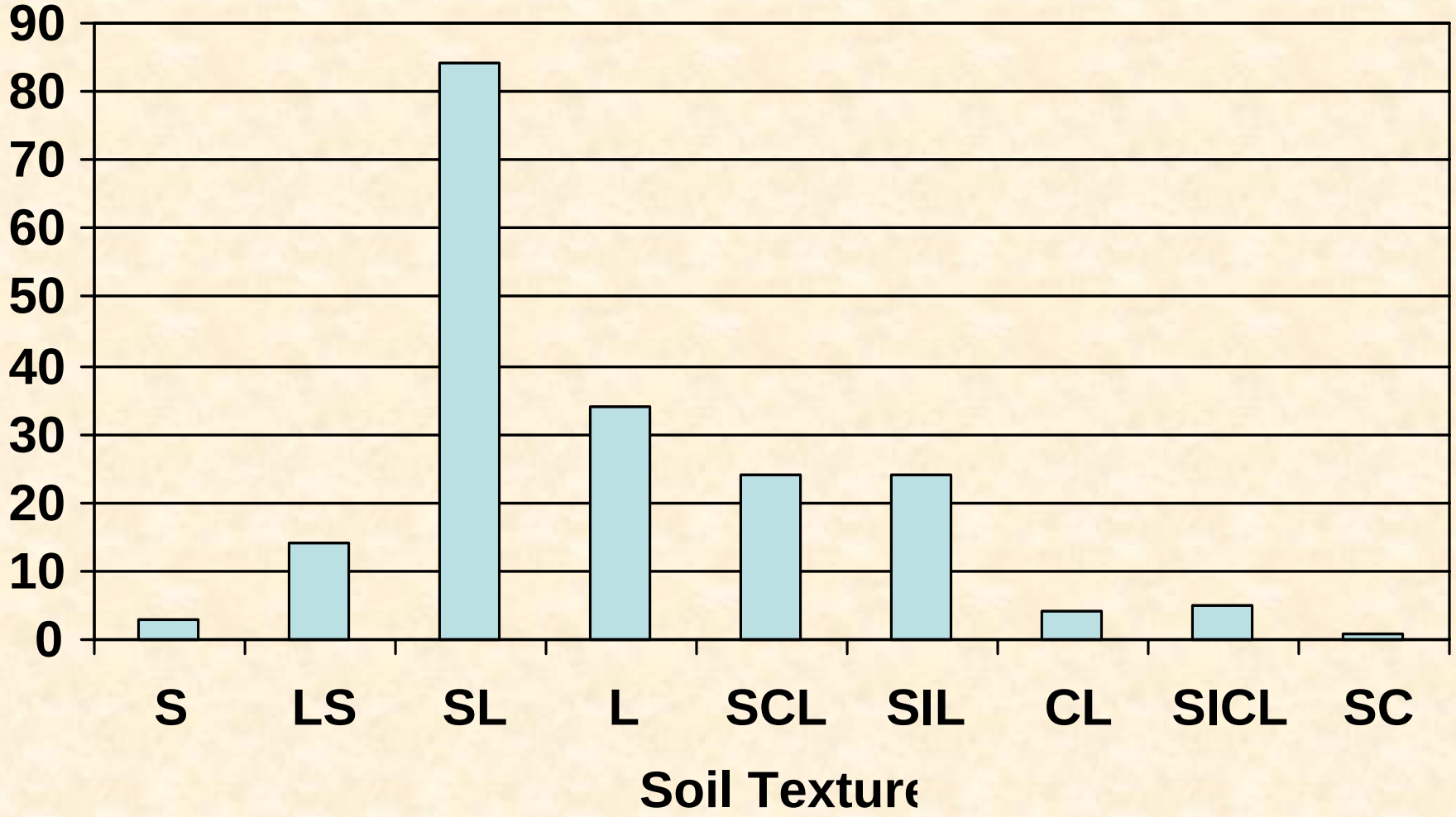
CT “thick section”



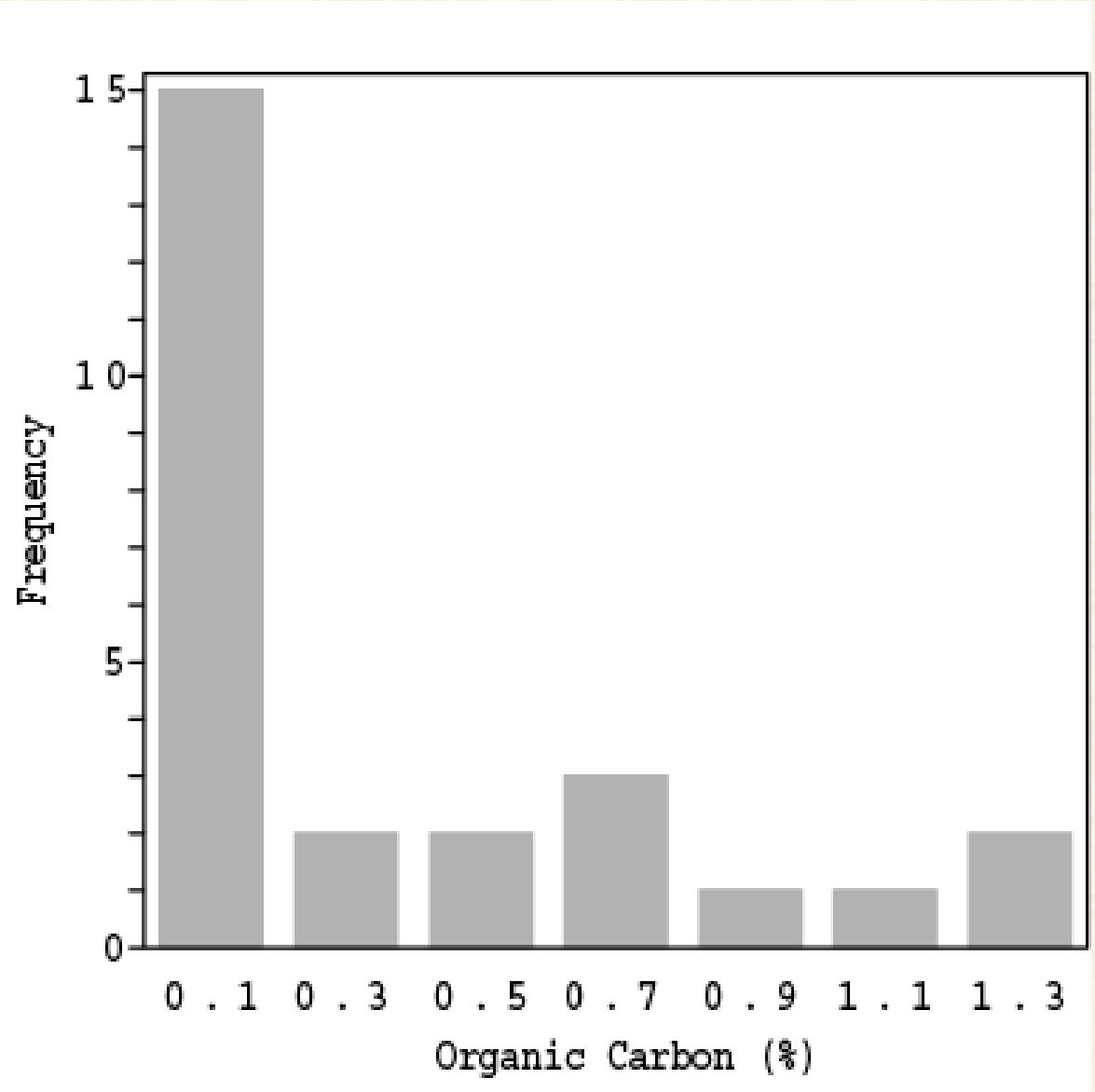
3-D image of vesicular pores



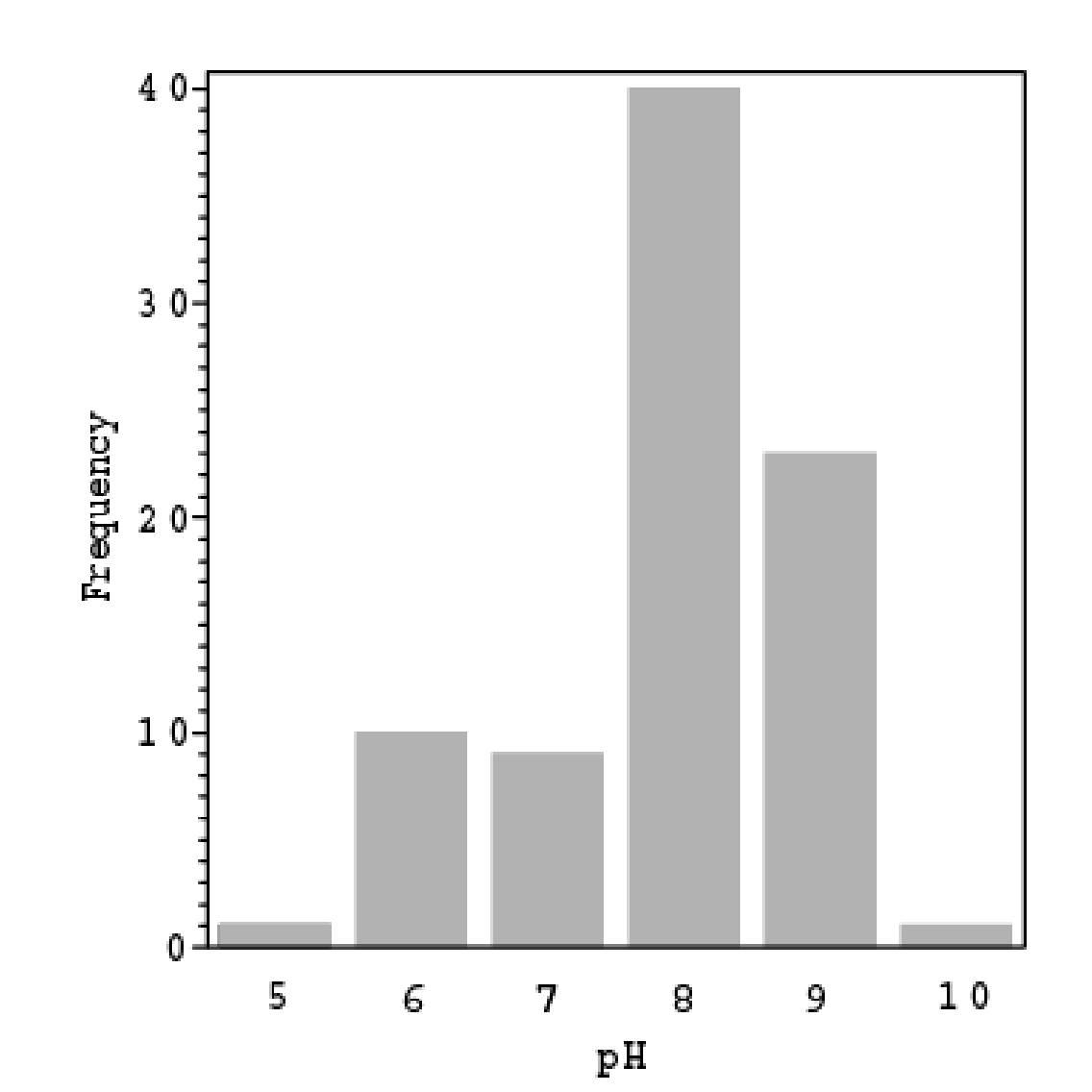
Vesicular Horizon Textures
(California only, n = 174)



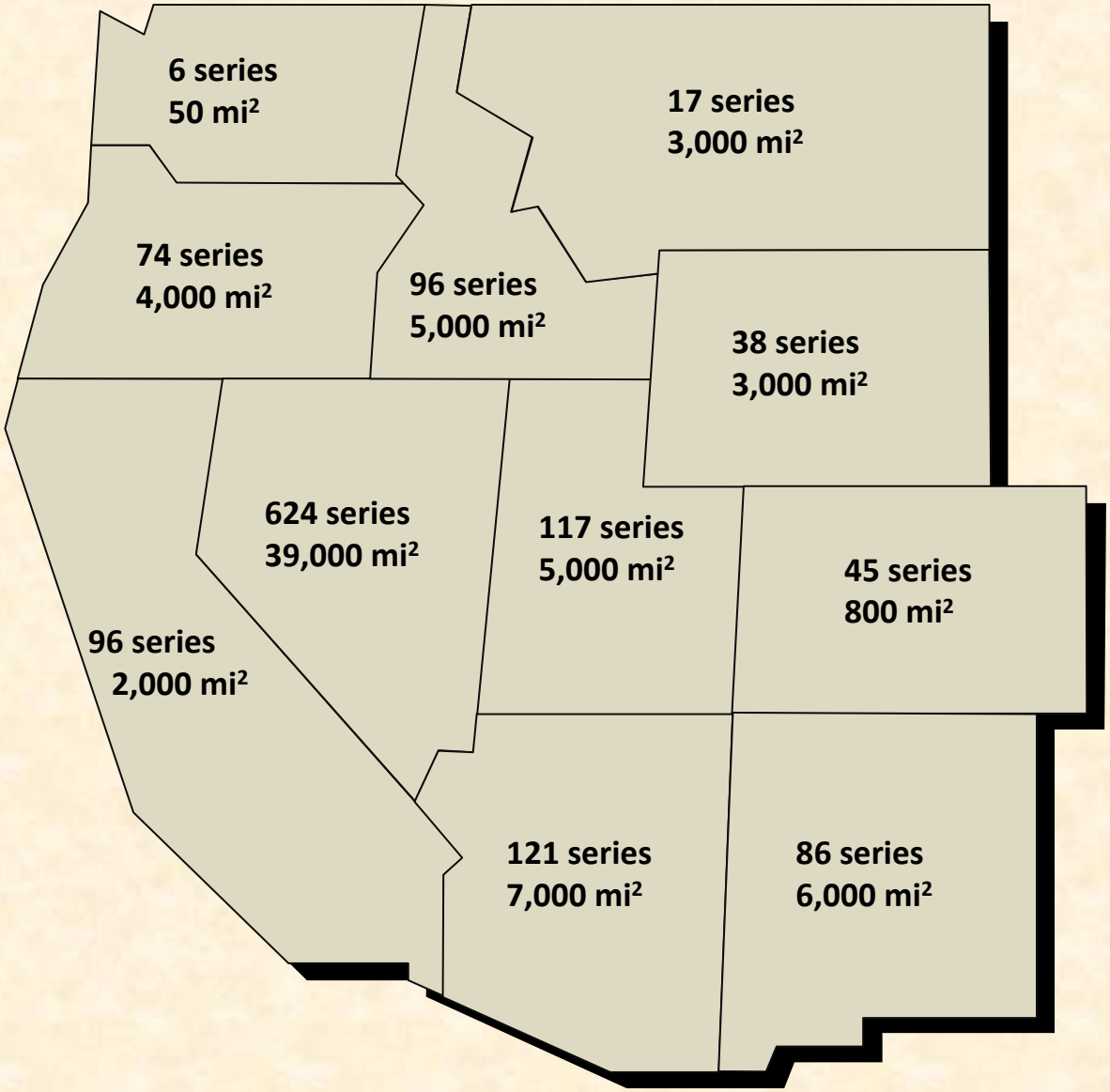
Organic Carbon



pH

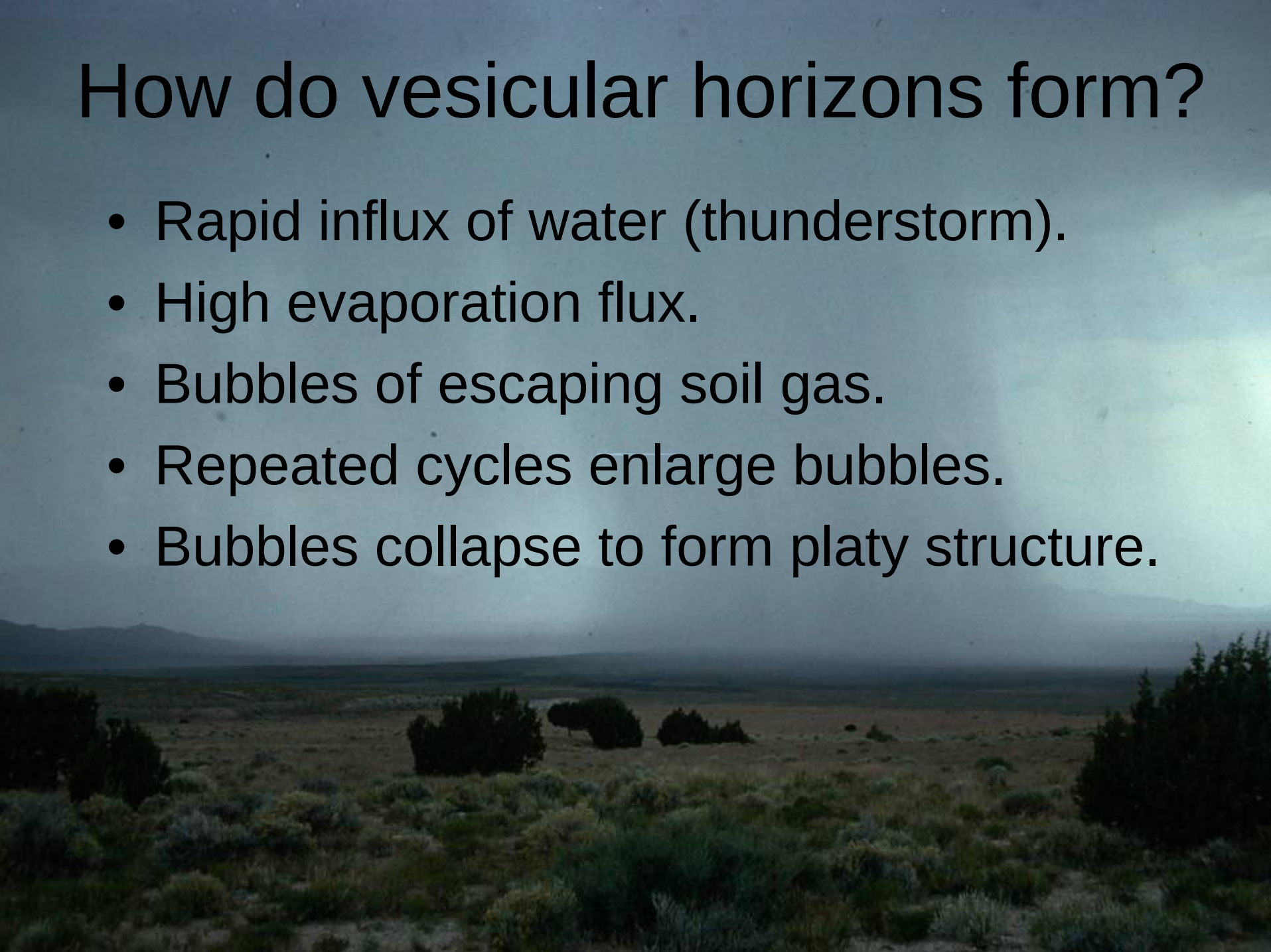


Vesicular Horizon Occurrence in western USA



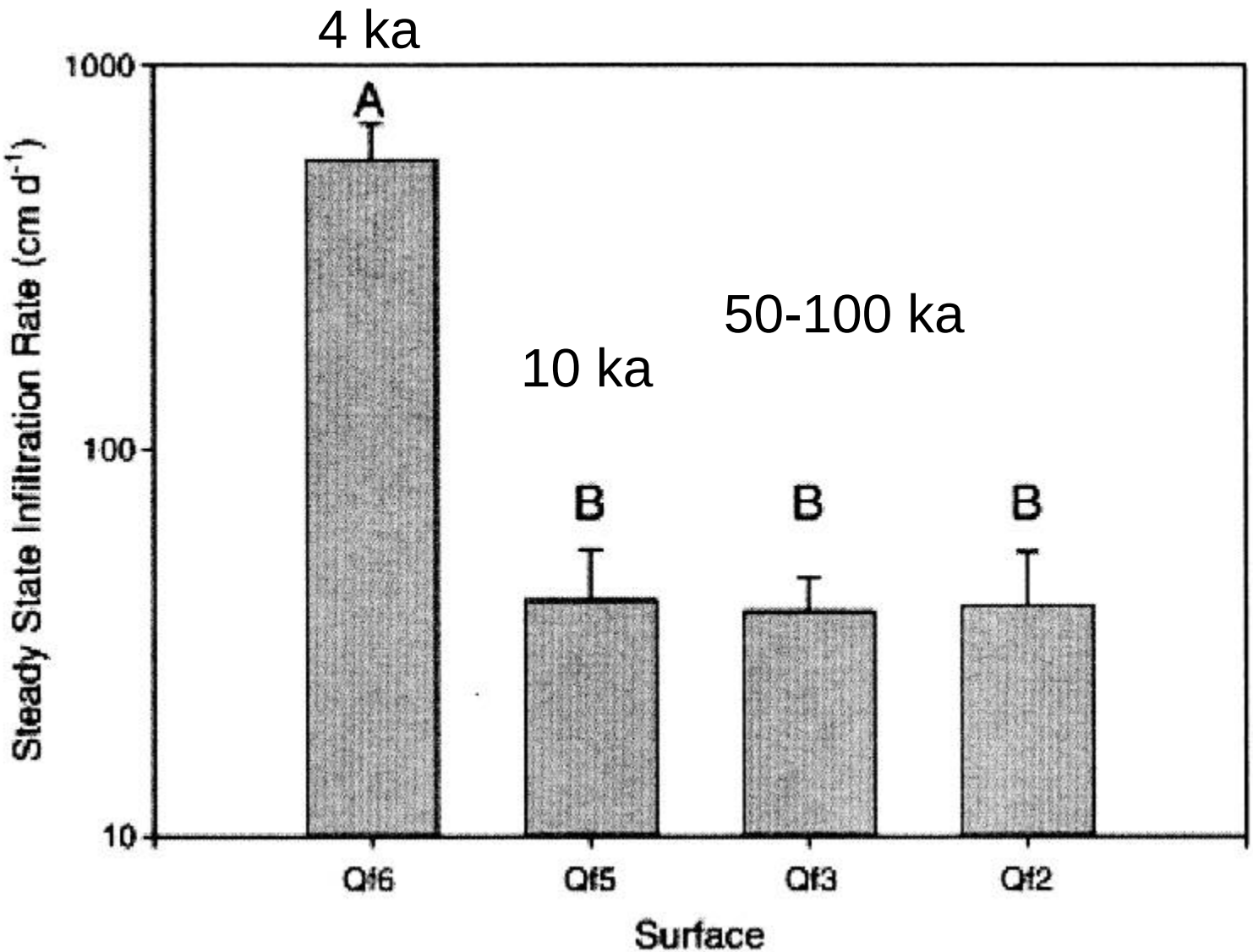
How do vesicular horizons form?

- Rapid influx of water (thunderstorm).
- High evaporation flux.
- Bubbles of escaping soil gas.
- Repeated cycles enlarge bubbles.
- Bubbles collapse to form platy structure.



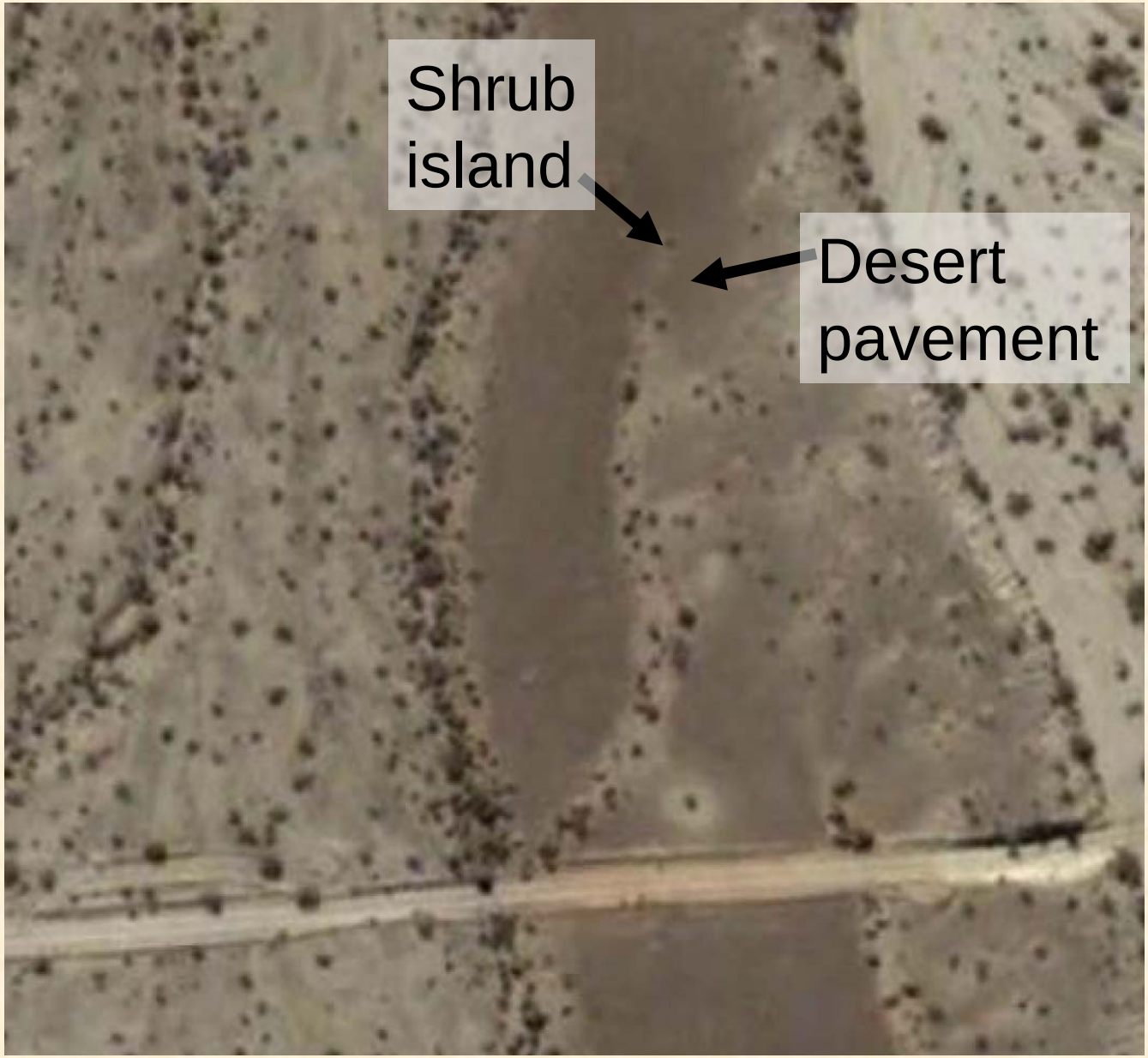
Ecological Significance of Desert Pavements & Vesicular Horizons

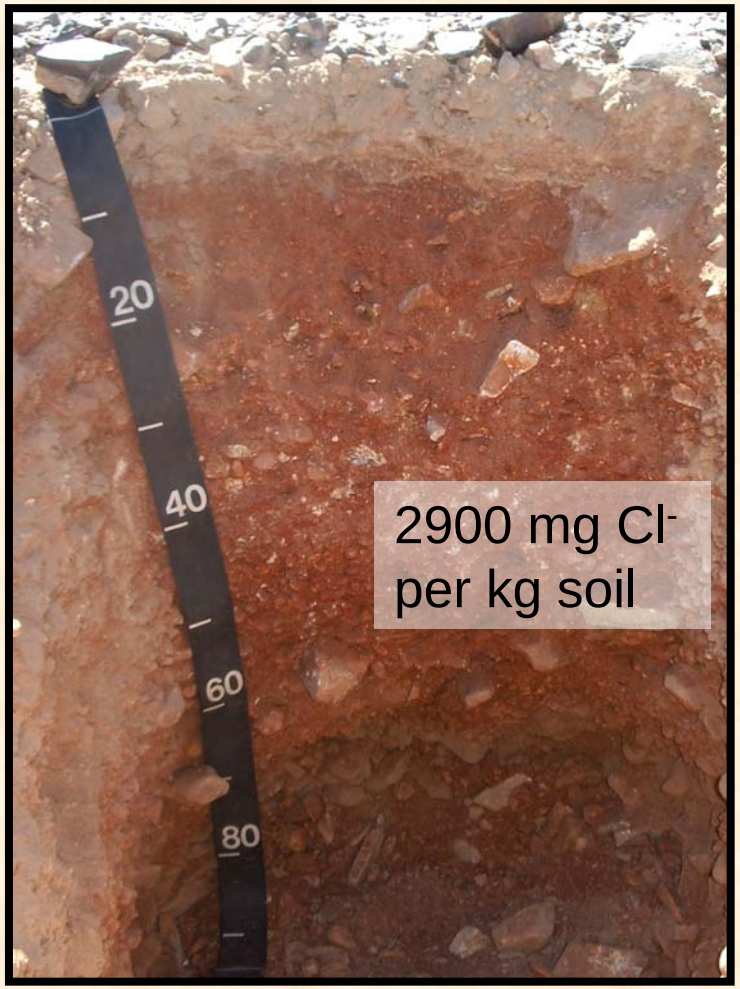
- Restrict infiltration rate.
- Redistribute water: runoff, runon
- Increase salinization.
- Accumulate nitrate.
- Source of dust if disrupted.



Meadows, Young, and McDonald. 2008. *Catena*

Aerial view of alluvial fan surfaces, Pinto Basin



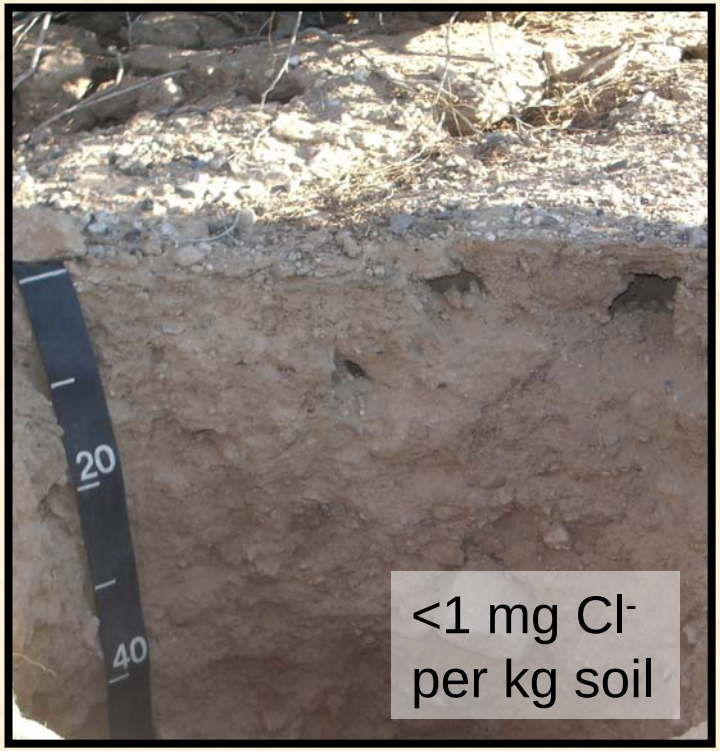


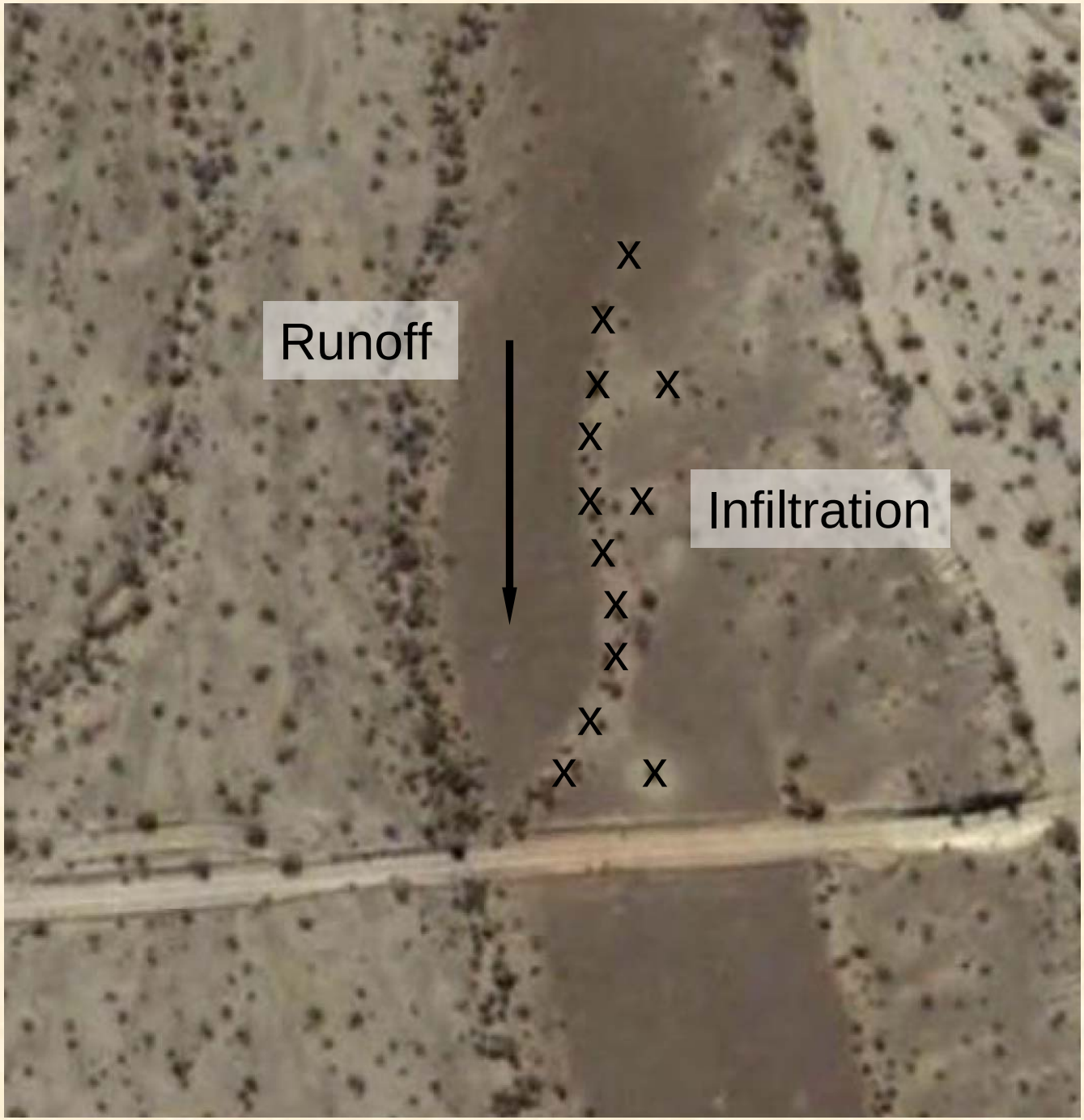
Desert Pavement
on old alluvial fan

Runoff >>> Infiltration

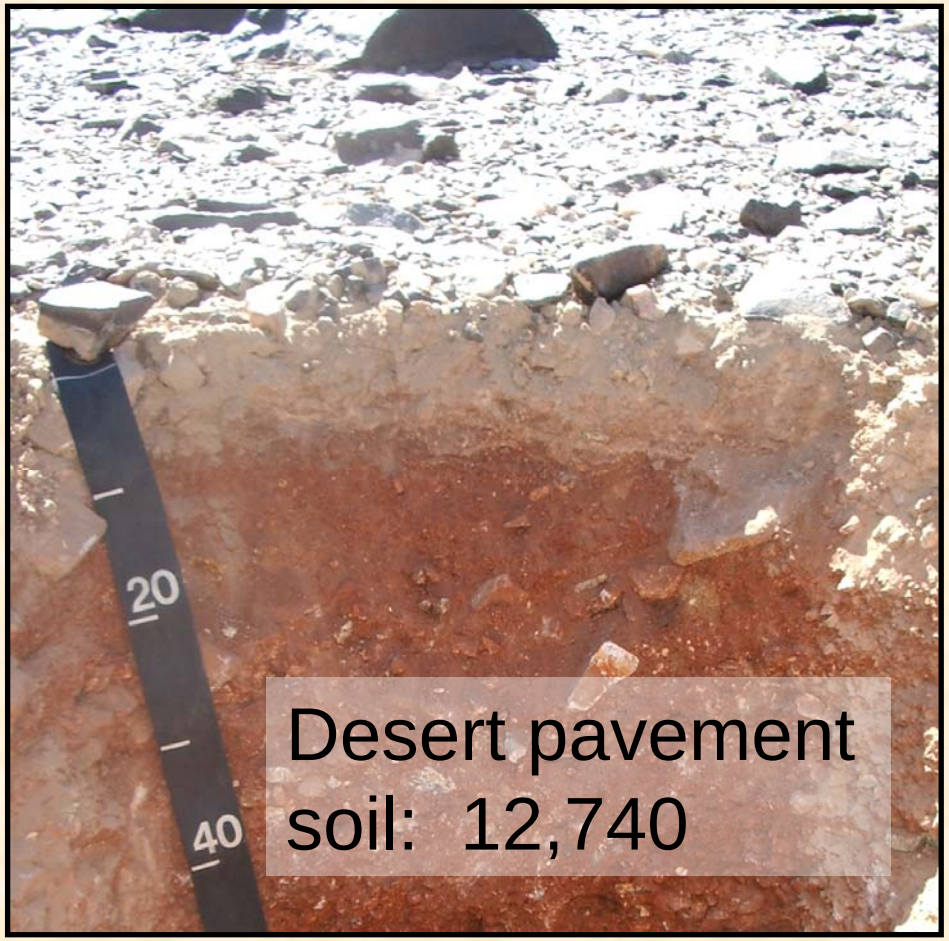
Shrub Island

Infiltration >>> Runoff




Runoff
Infiltration

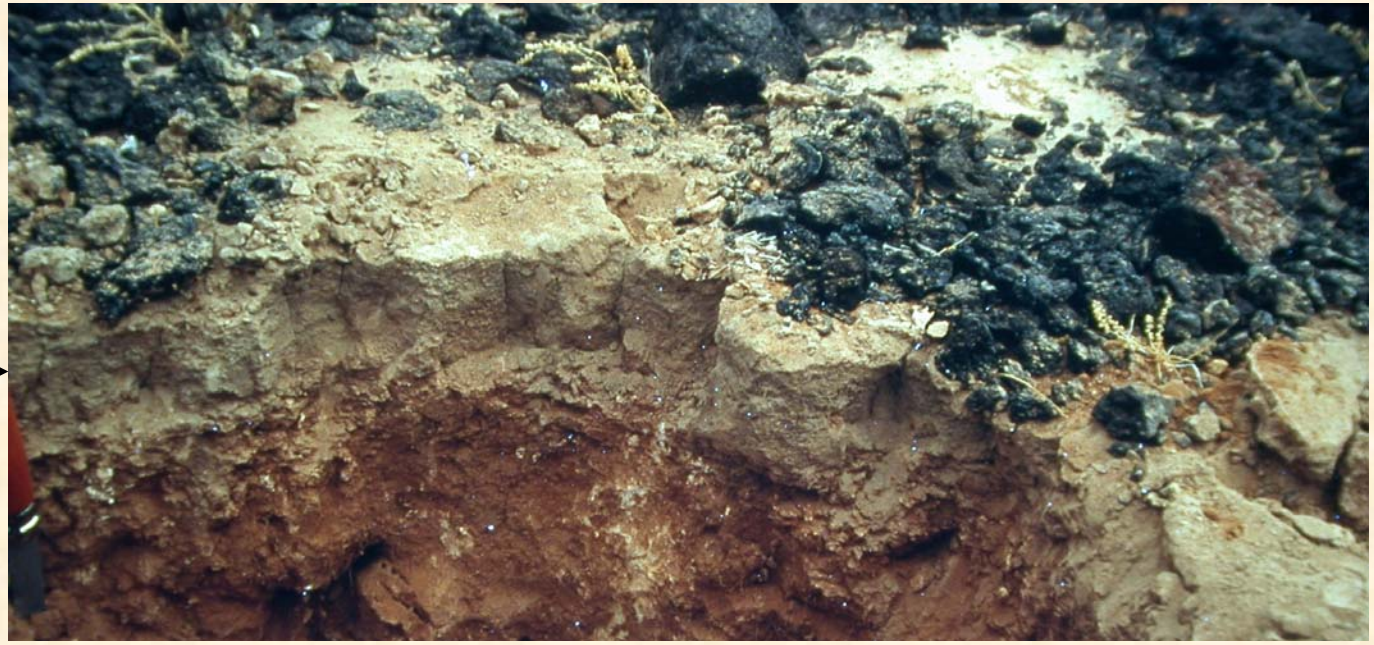
Nitrate-N content (kg ha^{-1})



<u>Perspective</u>

- Total N in midwest Mollisol: ~9,000 kg ha^{-1}

Desert Pavements & Vesicular Horizons:



- Control important soil processes.
- Need to inventory & study these features.
- Horizon designations are needed.

Acknowledgements

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