



## Vesicular Horizons

- Thin horizon at or near the soil surface
- Enriched in eolian silts and fine sands
- Contains vesicular pores and columnar structure parting to platy structure



A vesicular horizon (Av) and the distribution of silt in the soil profile (Rossi, 2009)





A sample with vesicular pores and the tops of columnar peds in a vesicular horizon

## Distribution

- Occur in deserts on every continent
- Estimated 200,000 km<sup>2</sup> in western United States
- Present in 1425 Official Series Descriptions

Type locations of soil series with vesicular horizons



# **Vesicular Pore Formation: The Effect of Microbes and Soil Temperature**

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## **Ecological Function**

- Regulate surface hydrology in arid lands
- Concentrate water in shrub islands



## Pedogenic Processes

#### 2. Wetting and drying cycles 1. Eolian deposition a. Recently deposited b. Accumulation of a. Unaltered eolian sediments eolian silts and fine sediment or bedrock b. Entrapped air bubbles in wet eolian sediments c. Expansion of air bubbles and polygonal cracking during drying Cause of pore expansion: Microbial respiration or **Thermal expansion?** d. Collapse of vesicles and formation of platy structure

## **Microbial Respiration**

 Pores re-created in lab by repeated wetting and drying of sterile and non-sterile soil



 Larger and more numerous pores formed in non-sterile soil compared to sterile soil



Results of micromorphometric analyses of nearly spherical vesicles and irregularly shaped vughs formed after 5 wetting and drying cycles



## **Thermal Expansion**

• Observed rate of vesicular pore expansion exceeds the rate predicted for thermal expansion based on the ideal gas law



Expansion of vesicles over successive wetting and drying cycles with a 20°C increase in temperature between wetting and drying

## Conclusions

- Microbial respiration is not necessary for vesicular pore formation, but may increase size and number of vesicles
- Thermal expansion alone does not account for the observed rate of vesicle expansion

### References

Figueira, H., and G. Stoops. 1983. Application of micromorphometric techniques to the experimental study of vesicular layer formation. Pedologie 33:77-89.

Rossi, A.M. 2009. Soil development and clast weathering on a moraine chronosequence, eastern Sierra Nevada, California. M.S. Thesis, University of California, Riverside

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