

Rates of Soil Carbon  
Accumulation and Transformation in a  
Ponderosa Pine Forest Using  
High Resolution Chronosequence  
Analysis

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# Chronosequence Analysis

$$S = f(t)_{cl,o,r,p}$$

S: soil formation

t: time

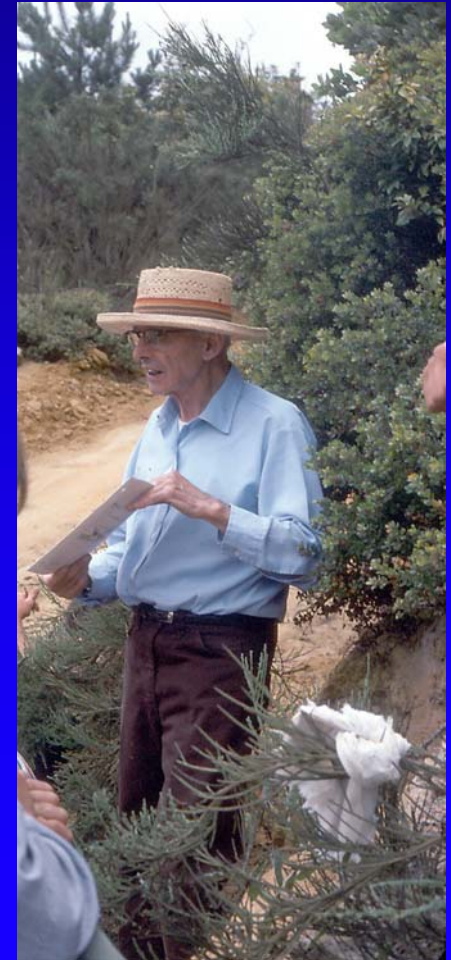
cl: climate

o: organisms

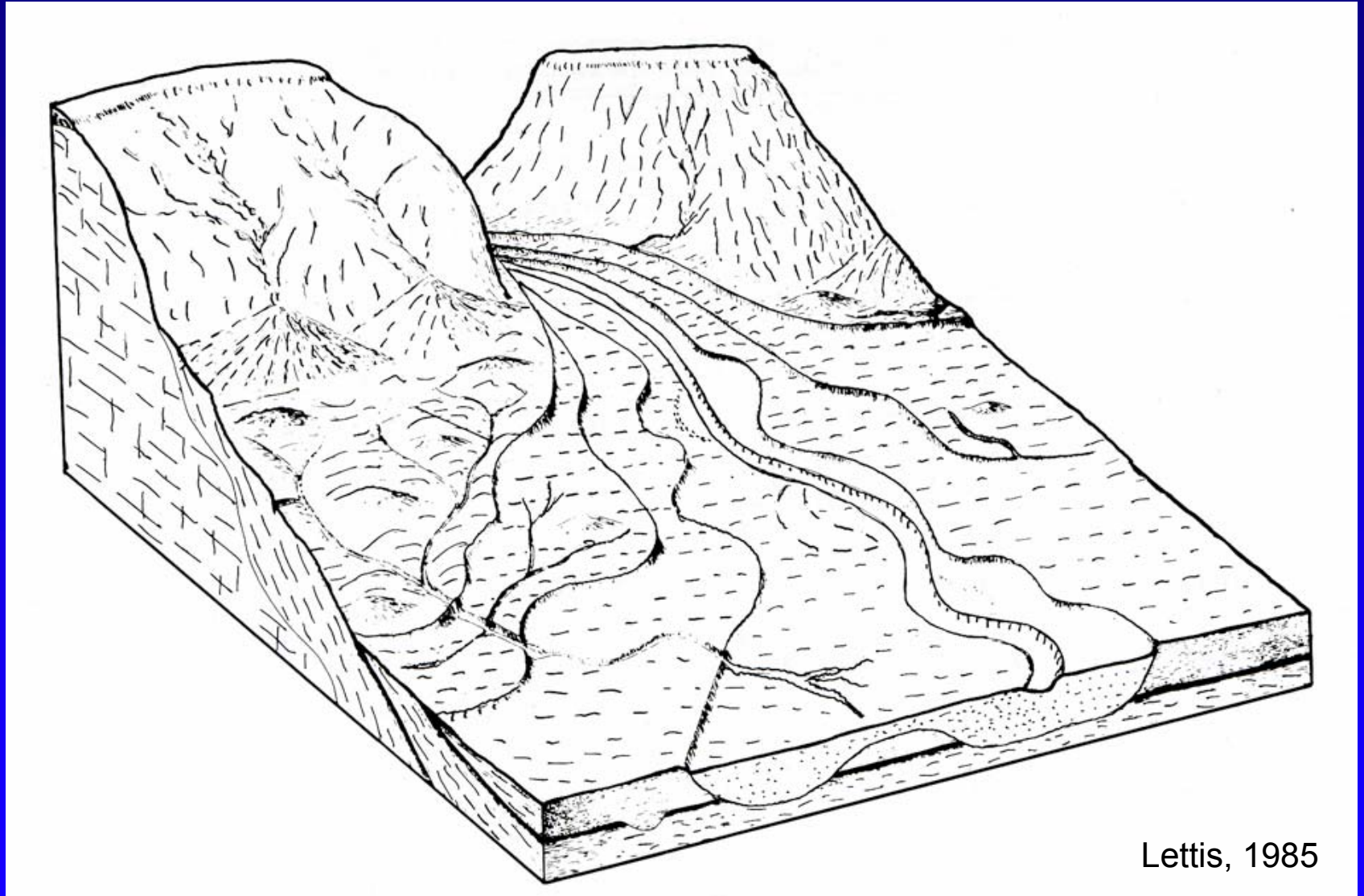
r: relief

p: parent material

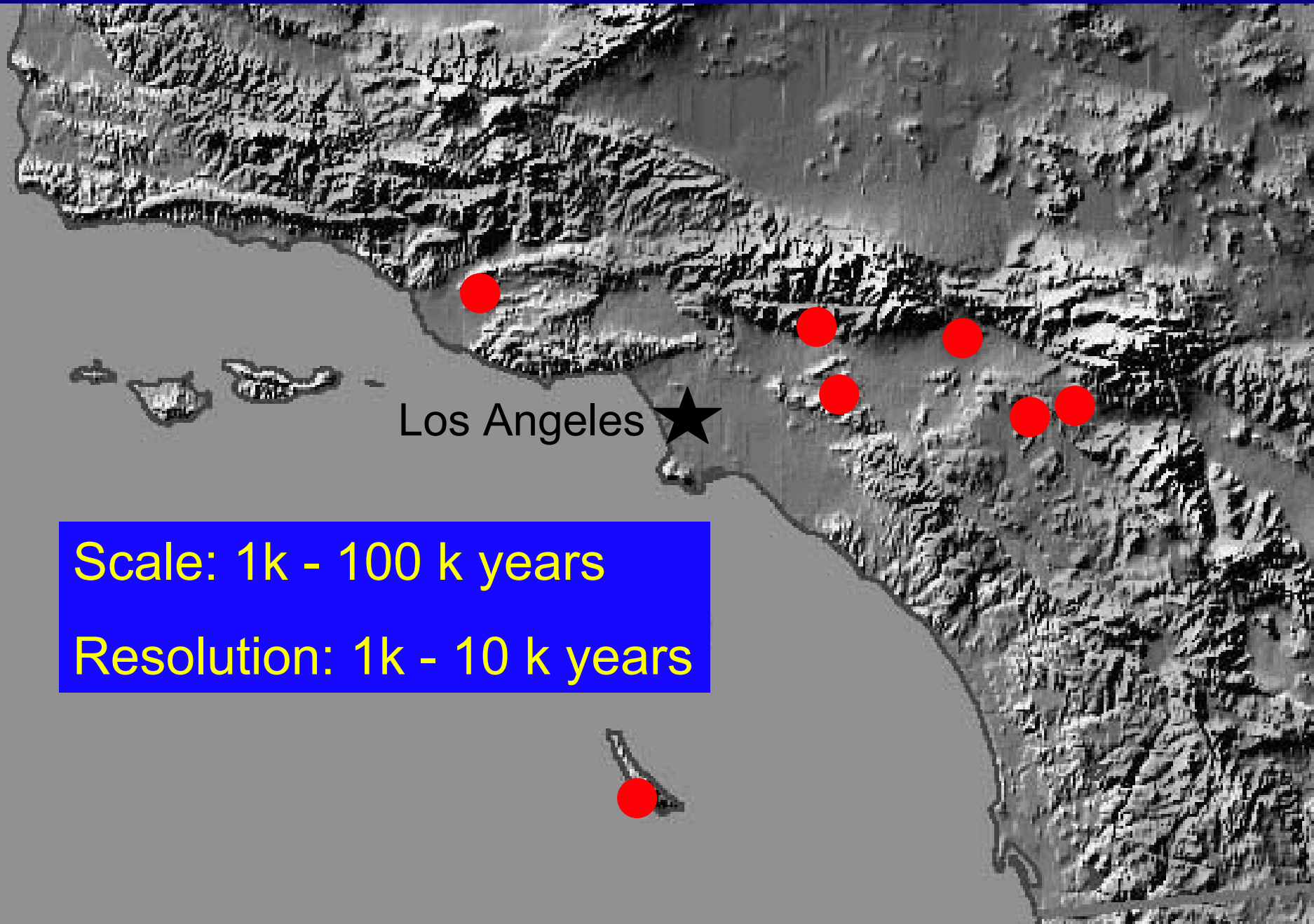
Hans  
Jenny



# Chronosequence of alluvial fan terraces



# Chronosequences in xeric southern California



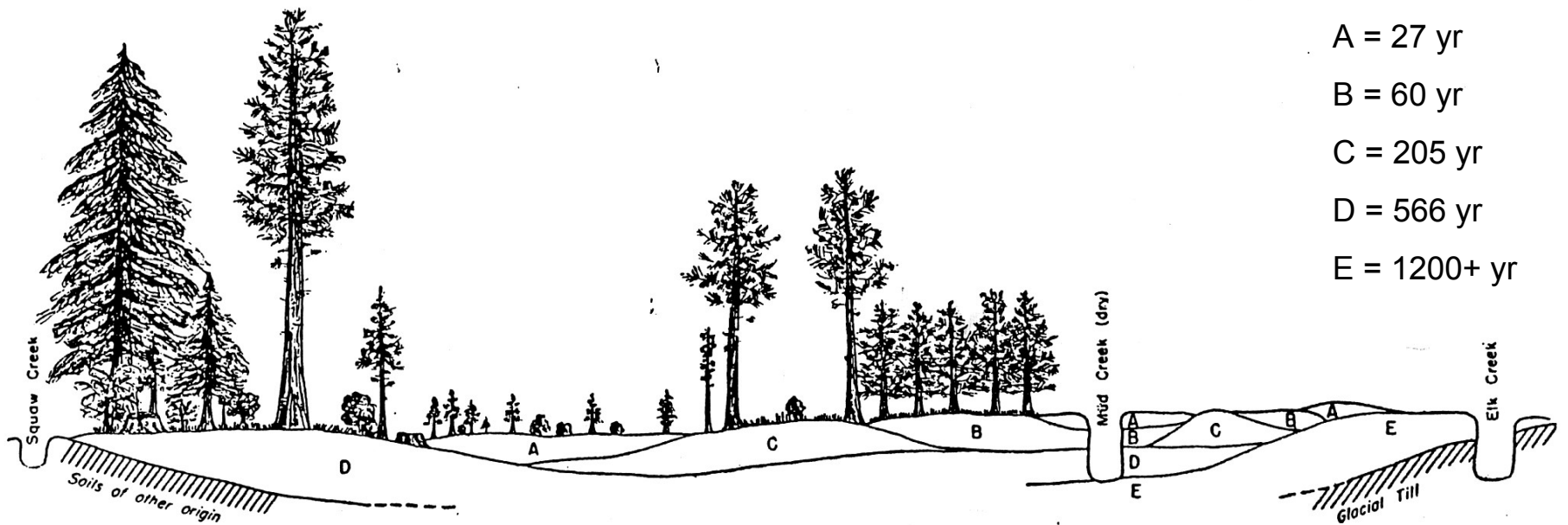
Los Angeles ★

Scale: 1k - 100 k years

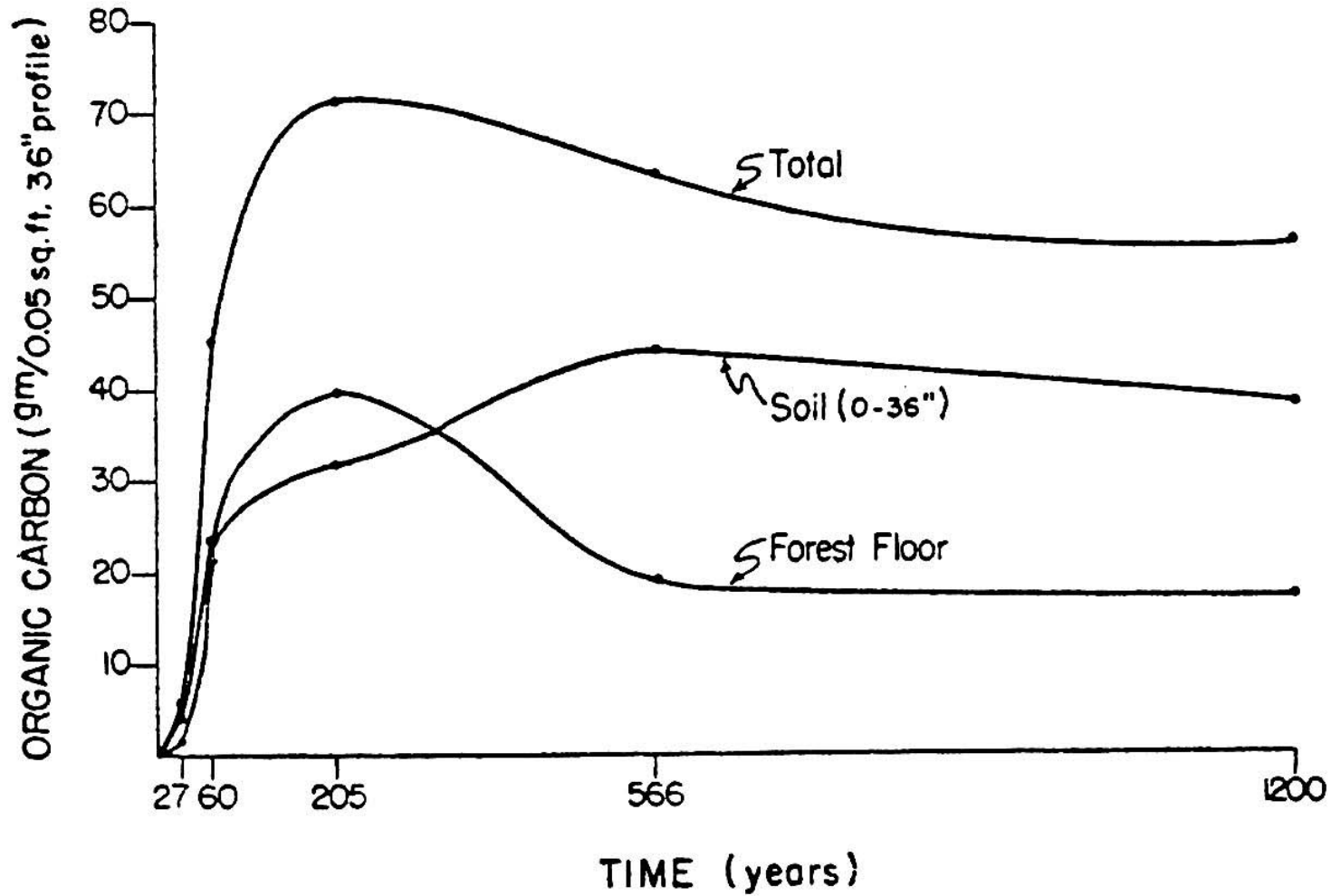
Resolution: 1k - 10 k years

Soil organic carbon studies  
need a shorter time span  
and greater resolution.

# Mt. Shasta Chronosequence



# Carbon accumulation in Mt. Shasta Chronosequence



$\text{kg m}^{-2}$

12.9

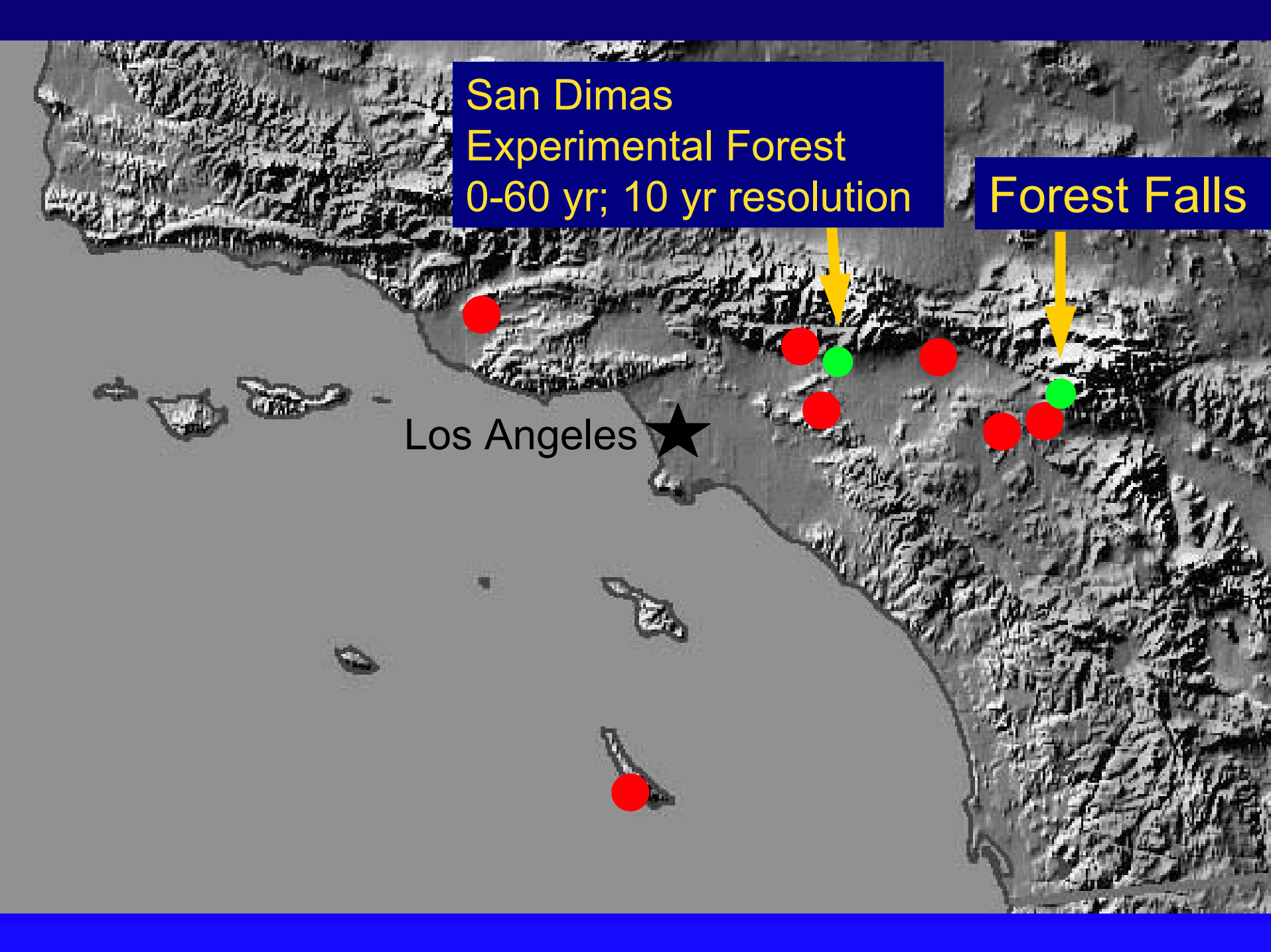
8.6

4.3

San Dimas  
Experimental Forest  
0-60 yr; 10 yr resolution

Forest Falls

Los Angeles













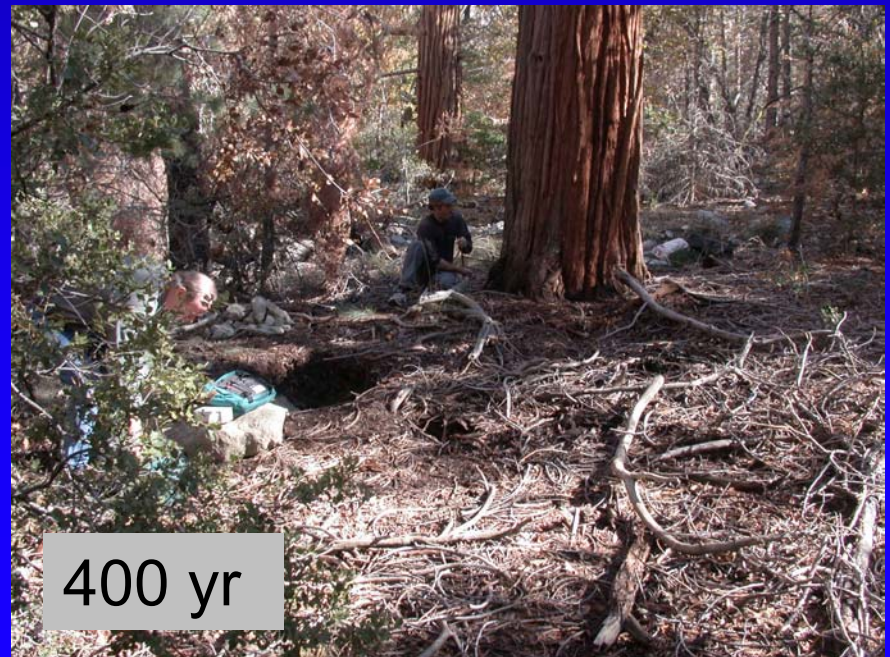
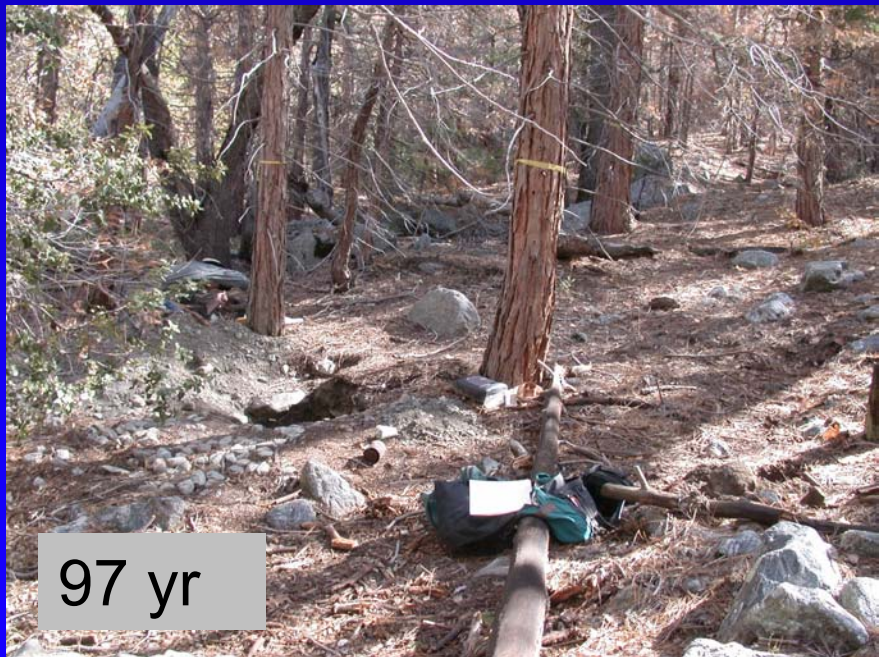


**Elevation = 1675 m**

**MAP = 650 mm**

**Geologic material: gneissic regolith**

**Soil texture: loamy sand (5% clay)**





# Objectives

- Assess the rate of carbon accumulation on a scale of decades.
- Determine the forms of soil organic matter as a function of soil age.
- Interpret the processes of carbon incorporation and storage the soils.



# **Initial Field investigations**





$<0.5\text{ yr}$



28 yr



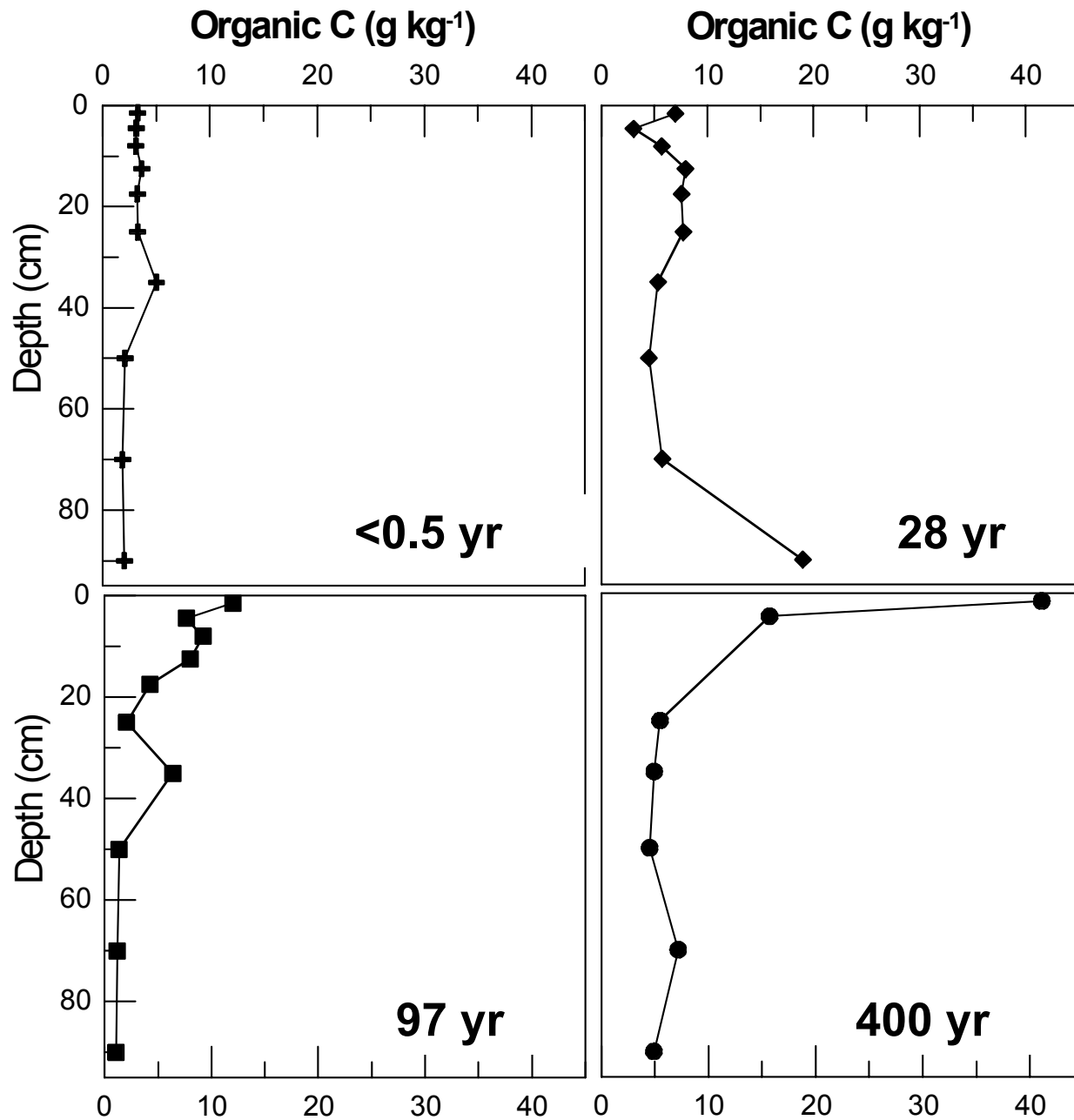
97 yr



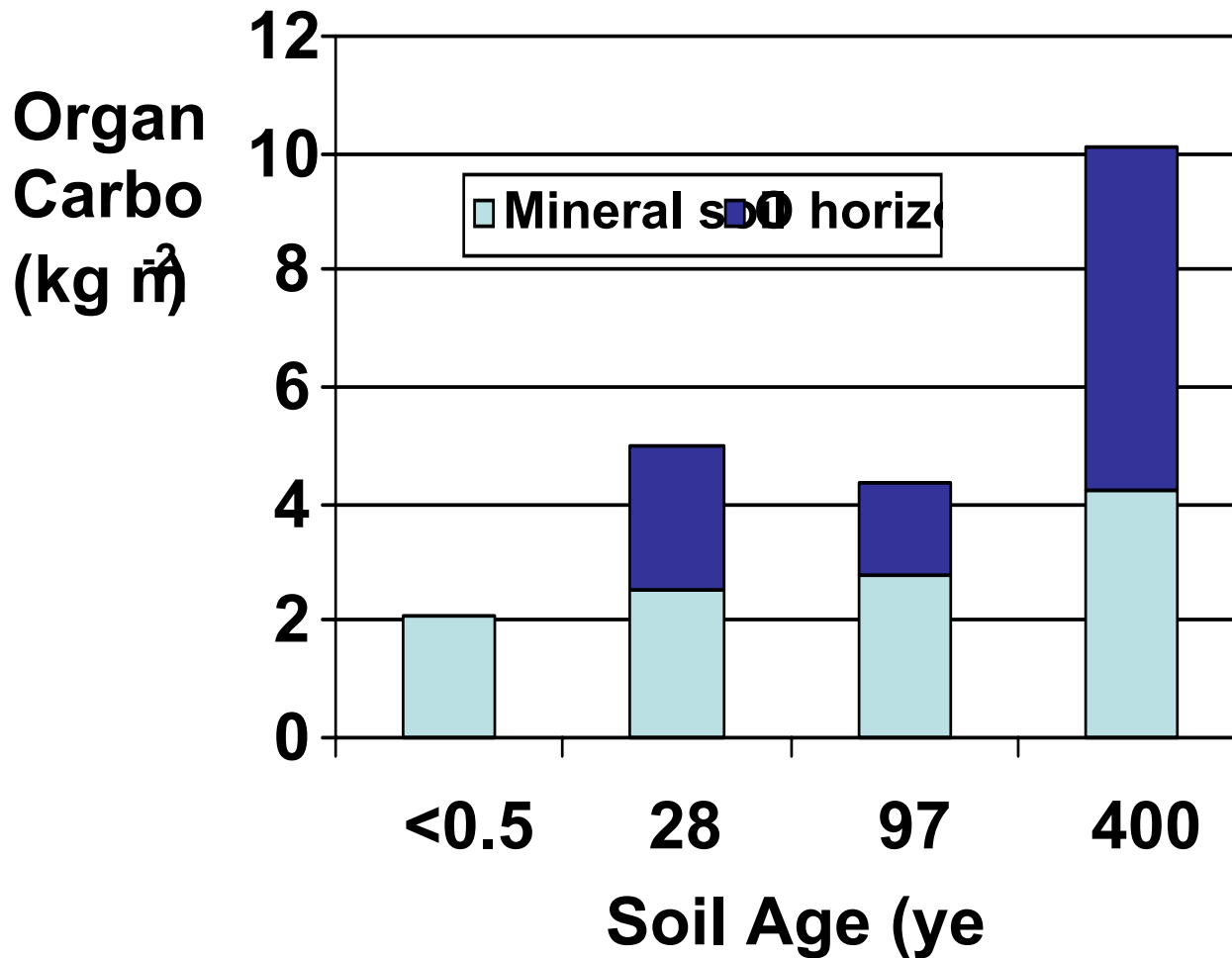
400 yr



# Initial Laboratory Results



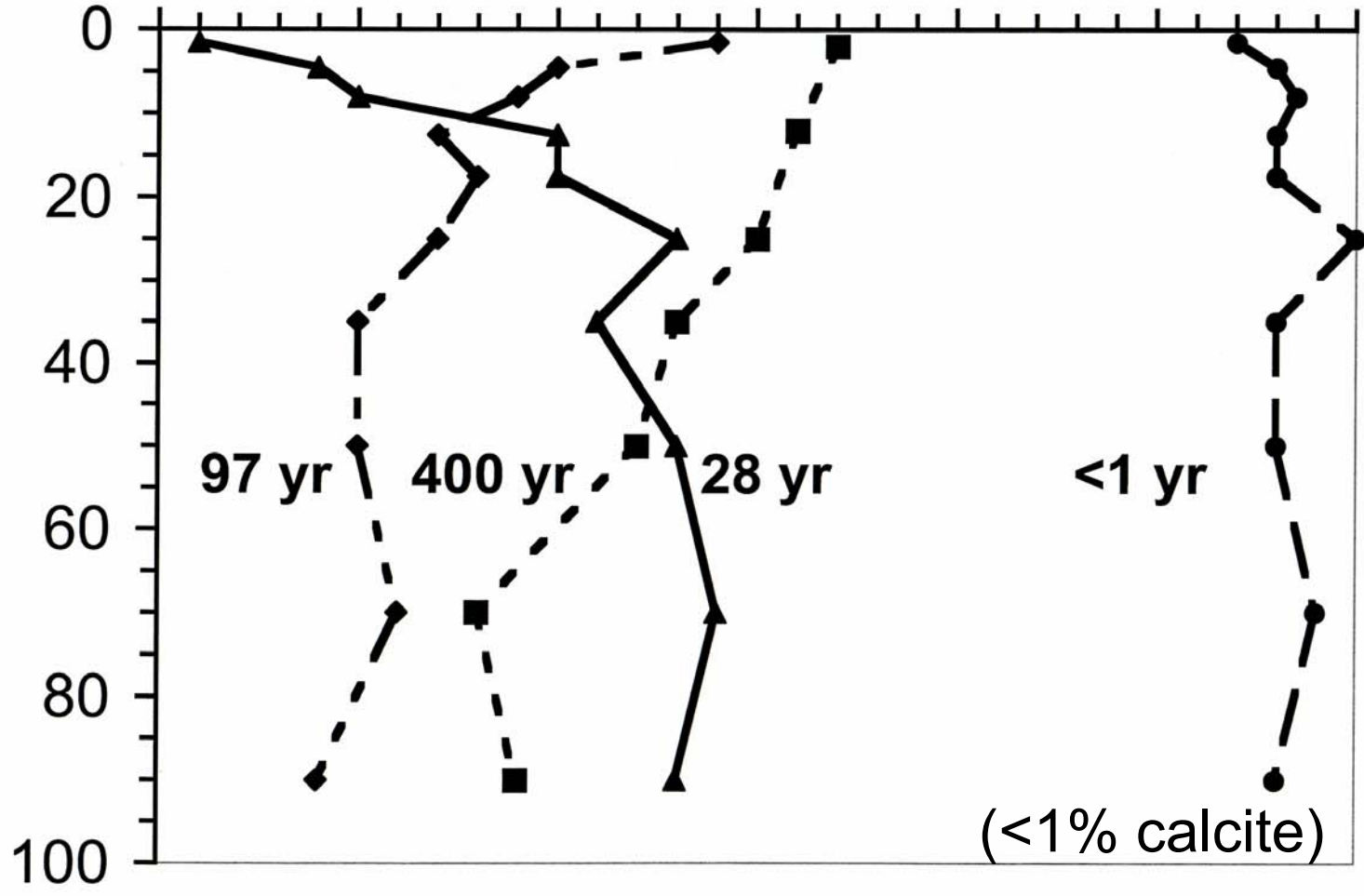
# Organic Carbon Storage to 80 cm depth



pH

5.0 5.5 6.0 6.5 7.0 7.5 8.0

Depth, cm



97 yr

400 yr

28 yr

<1 yr

(<1% calcite)





	Mt. Shasta (566 years)	Forest Falls (400 years)
	----- OC kg m <sup>-2</sup> -----	
Litter	4.3	6.0
Mineral soil	9.5	4.2
Total	13.8	10.2

# Future Work

- Sample soils on more flow ages
  - especially <200 yr
- Determine changes in forms of SOM
  - C by size fraction
  - solid state  $^{13}\text{C}$  NMR
- Investigate processes
  - litterfall
  - litter decomposition (litter bags)
  - soil fauna (pitfall trapping)
  - fine roots
  - soil respiration
  - microbial characterization (biomass, plfa)
  - soil temperature
  - micromorphology



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