

## LOW CARB

### Lingering Organic and Water Isotopic Signatures in Carbonate

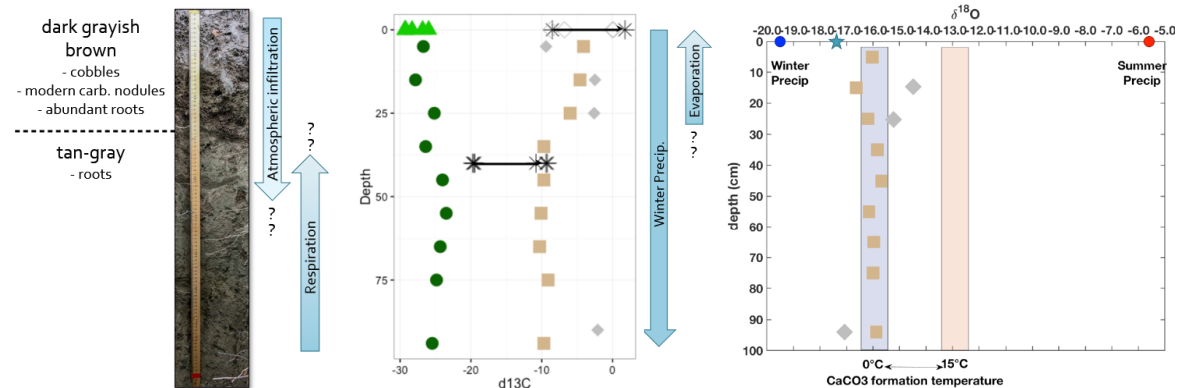
**Background:** Soil carbonate forms slowly

**Research question:** What are the sources of carbon and oxygen in soil carbonate?

**Hypothesis:** We expect the carbon of soil carbonate to reflect the respired of plant material, nearby carbonate sources, or  $\text{CO}_2$  in the atmosphere. We expect the oxygen to be from water from the wintertime or summertime precipitation.

**Methods:** To investigate this question, we dug a 1m trench into a paleosol in City Creek Canyon. We gathered soil, roots, and carbonate nodules from the trench (about every 10 cm), limestone sources from nearby clasts, rinds, snails, and springs, plants from the surface, and  $\text{CO}_2$  from the soil. We estimated expected  $\delta^{13}\text{C}$  values of soil carbonate from the  $\text{pCO}_2$  and  $\delta^{13}\text{C}$  of  $\text{CO}_2$  from the soil. To examine sources of carbon in soil carbonate, we modeled  $\delta^{13}\text{C}$  values of soil carbonate using estimates of vegetation, and past climate (Cerling, 1989; written by Huth, 2019). We also gathered  $\delta^{18}\text{O}$  values of monthly precipitation from waterisotopes.org for City Creek Canyon to examine the source of water for soil carbonate. Organic carbon  $\delta^{13}\text{C}$  values were measured on EA-IRMS, and  $\delta^{13}\text{C}$  and  $\delta^{18}\text{O}$  values of carbonate were measured using a GasBench-IRMS.

**Results:**  $\delta^{13}\text{C}$  values of soil carbonate were most strongly tied to early summer formation on a C3 vegetated landscape. They were not altered by nearby limestone sources after deposition. The nodules in the soil had more positive  $\delta^{13}\text{C}$  values, reflecting a later season of formation and possibly longer time of formation.  $\delta^{18}\text{O}$  values of soil carbonate reflect water from winter time precipitation. And again, nodules reflect slower and later growth with evaporative enrichment.



**Figure 1:** A) Cross section of the pit scaled to the depth from the surface of the pit (cm) in the figures. B)  $\delta^{13}\text{C}$  values of plants (green triangles), roots (green circles), nearby carbonates (open grey diamonds), gas from modern air and depth in the soil and the expected carbonate  $\delta^{13}\text{C}$  values precipitated from these gasses (stars arrow stars), the bulk soil carbonates (brown squares), and the carbonate nodules in the soil (grey diamonds). C)  $\delta^{18}\text{O}$  values of the soil the bulk soil carbonates (brown squares), and the carbonate nodules in the soil (grey diamonds), winter precipitation (blue circle), summer precipitation (red circle) and expected  $\delta^{18}\text{O}$  values of soil carbonate from these water sources (blue and red rectangles), and snow and atmospheric values (stars).