Sierra Nevada Time Series

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Data preparation script for Sierra Nevada time series analysis

Merge templates with 14C, C, and N data

Radiocarbon analyses for the 2001 samples were not run originally, but were completed on archived samples in 2020.
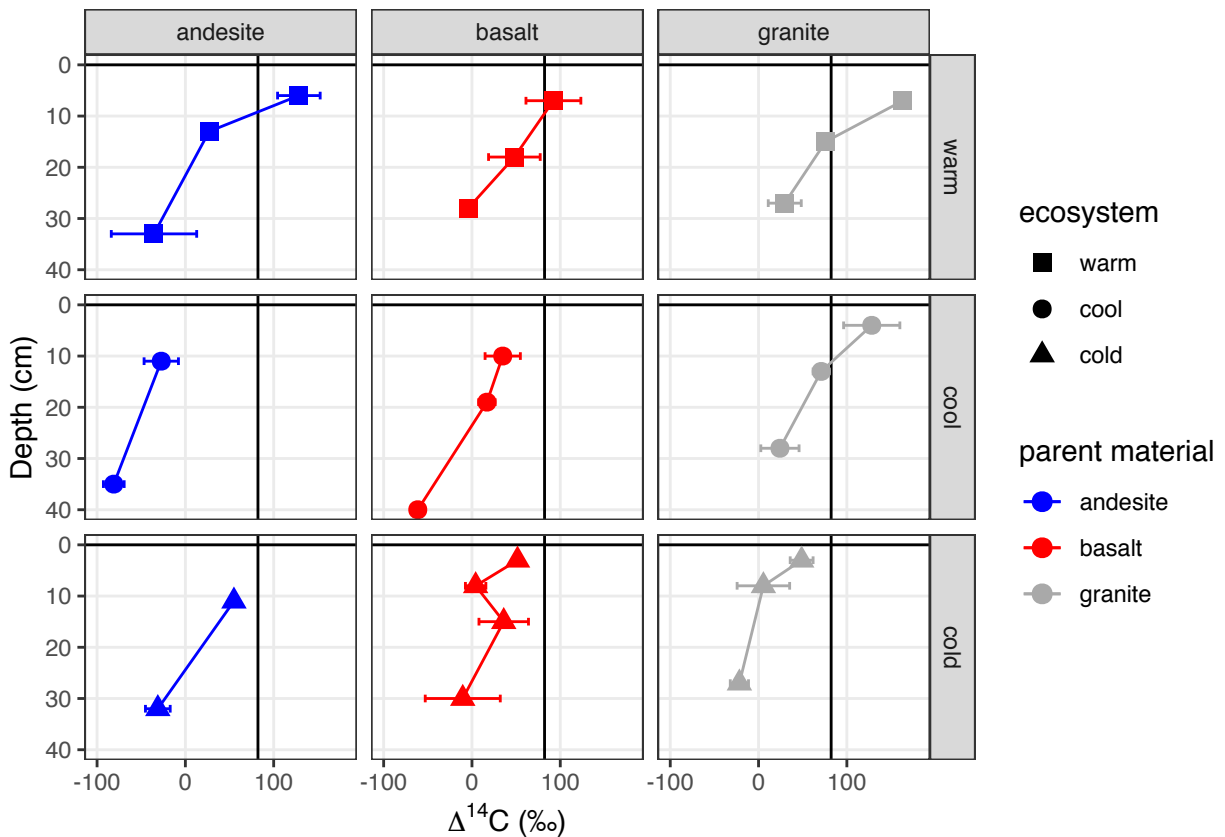
2001 mean radiocarbon profiles

Fig. 1. Mean profile Δ^{14}C for 2001 samples

Caption: Mean Δ^{14}C by depth for each site in 2001. Error bars show ± 1 standard deviation, solid vertical line shows Δ^{14}C of the atmosphere in the year of sampling.
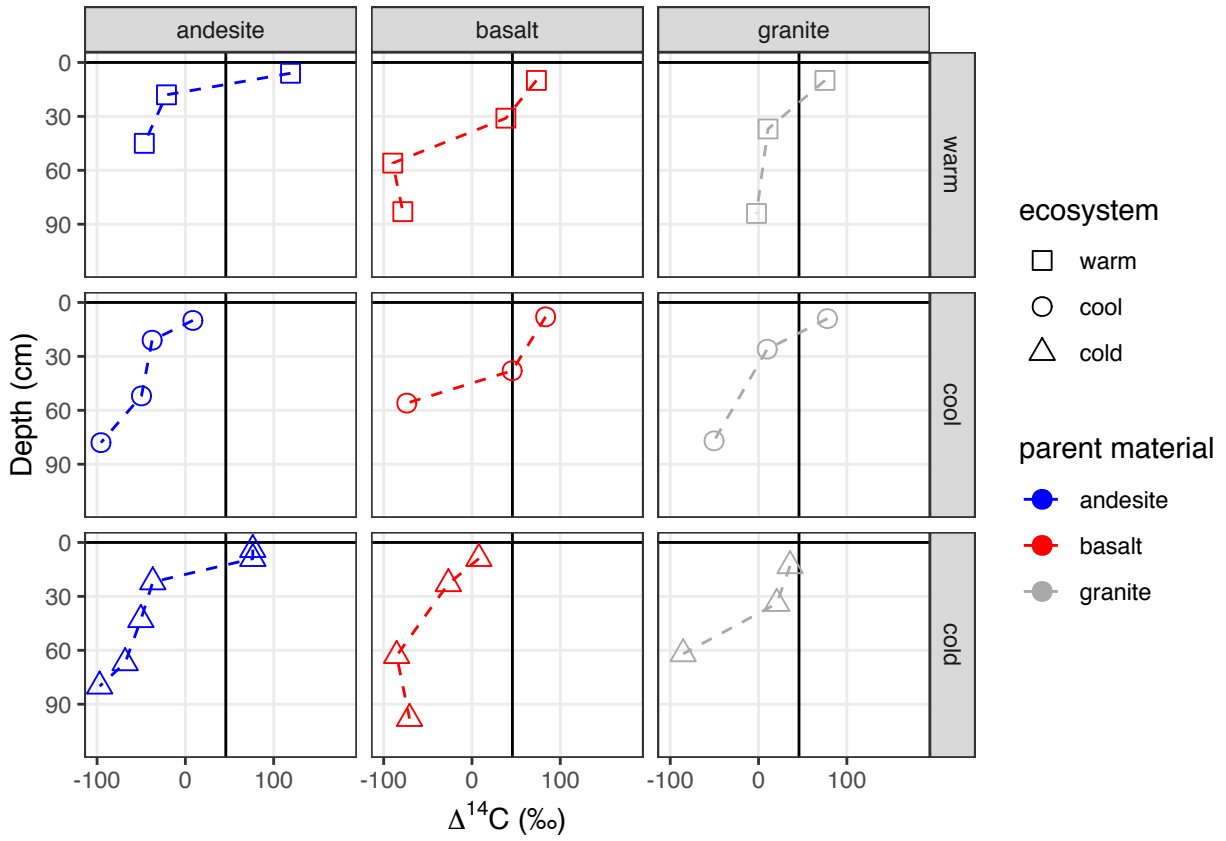
2009 radiocarbon profiles

Fig. 2. Profile Δ^{14}C for 2009 samples

Caption: Profile Δ^{14}C by depth for each site in 2009. Solid vertical line shows Δ^{14}C of the atmosphere in the year of sampling. Error bars not shown as only a single replicate profile was analyzed per site.
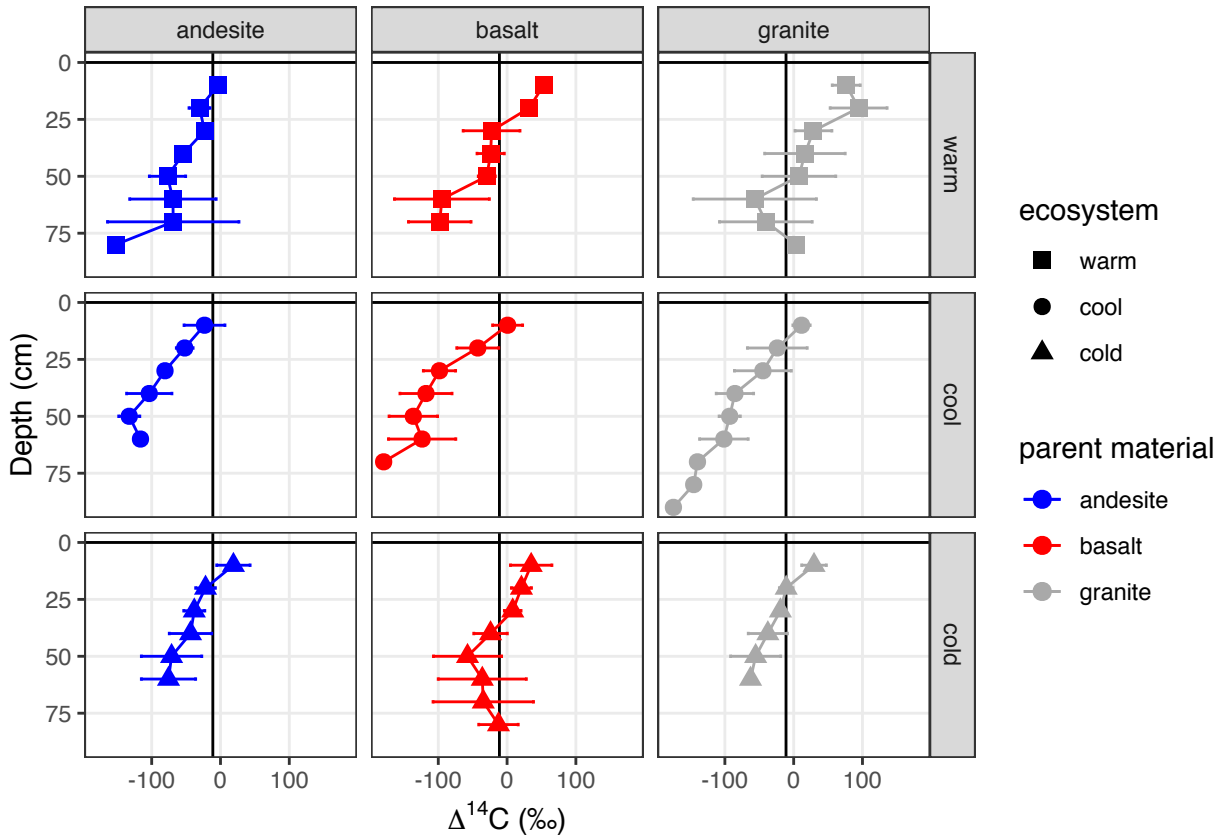
2019 mean radiocarbon profiles

Fig. 3. Mean profile Δ^{14}C for 2019 samples

Caption: Mean Δ^{14}C by depth for each site in 2019. Error bars show ± 1 standard deviation, solid vertical line shows Δ^{14}C of the atmosphere in the year of sampling.
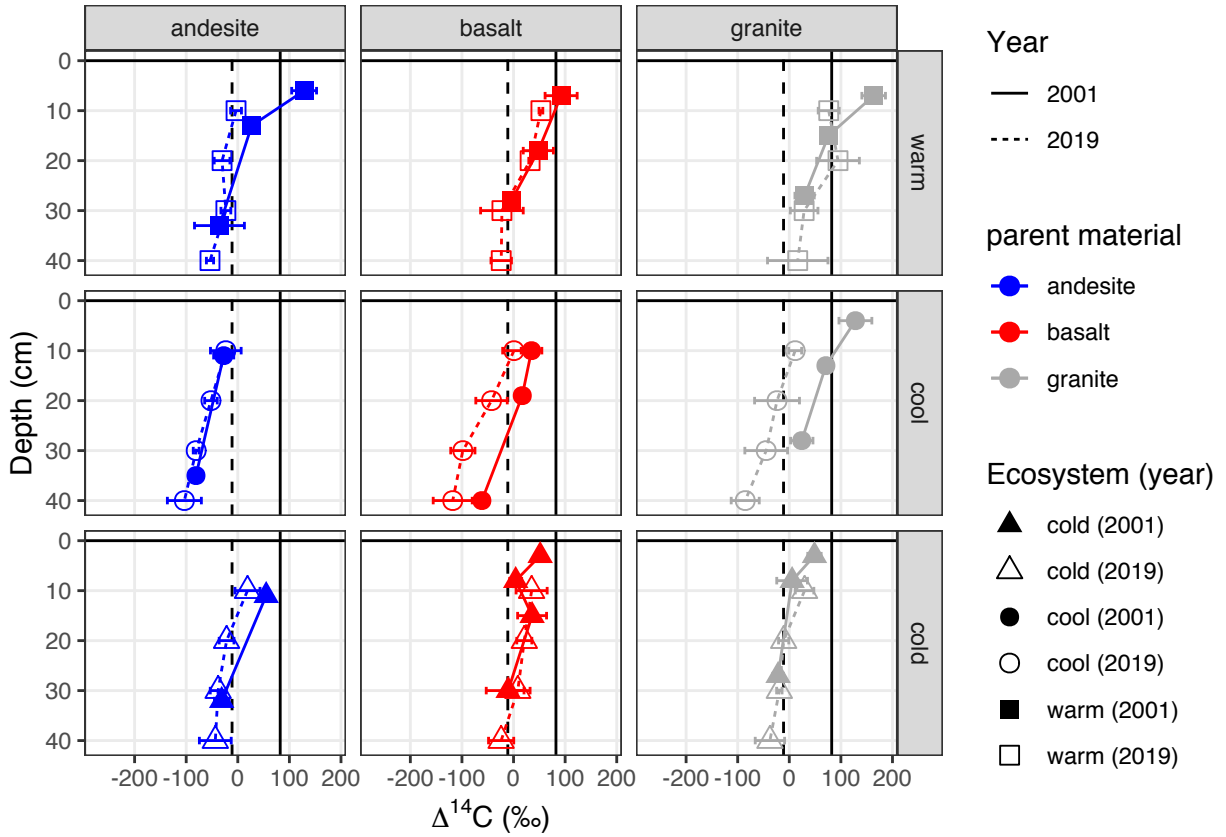
Change in Δ^{14}C over time between 2001 and 2019

Fig. 4. Mean profile Δ^{14}C for 2001 and 2019 samples

Caption: Mean Δ^{14}C by depth for each site in 2001 and 2019. Error bars show ± 1 standard deviation. Vertical lines show Δ^{14}C of the atmosphere in 2001 (solid) and 2019 (dashed).
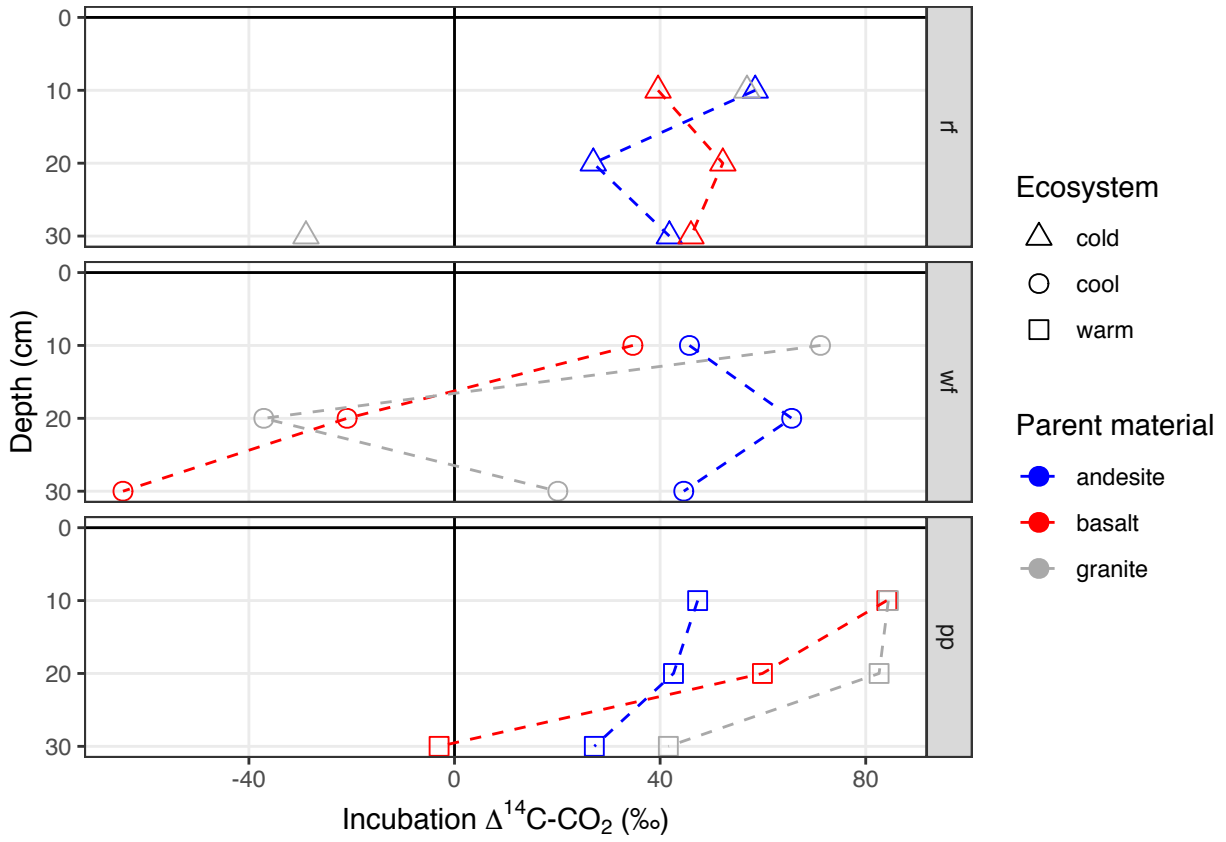
Incubation Δ^{14}C-CO$_2$ for 2019 bulk soils

Fig. 5. Rep 1 Δ^{14}C-CO$_2$ of 2019 bulk soil incubations

Caption: Δ^{14}CO$_2$ by depth for each site in 2019. (Still waiting for data from laboratory duplicates). Note that the 10-20 cm increment sample from the cold granite site appears to have been contaminated: Δ^{14}C-CO$_2$ = -396.7.

Incubation vs. bulk soil $\Delta^{14}C$

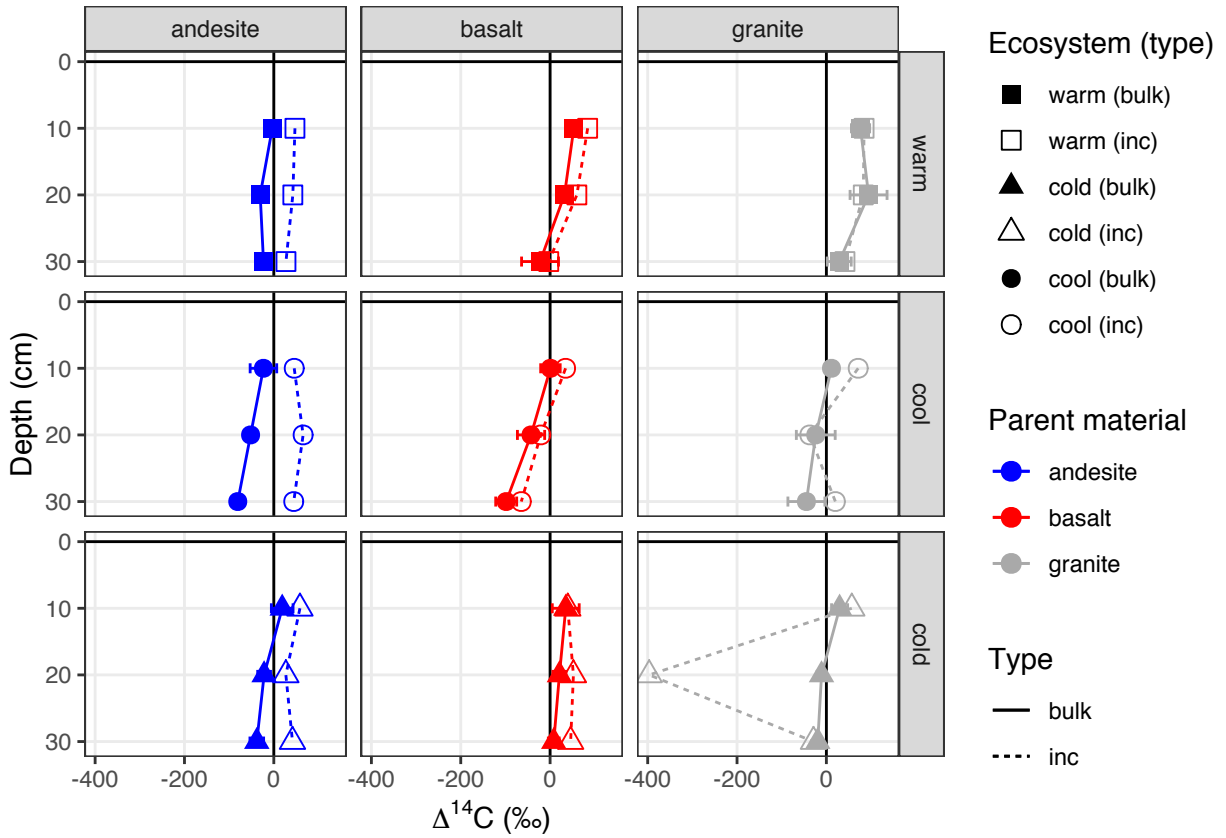**Fig. 6. $\Delta^{14}C$ of 2019 bulk soil incubations and corresponding bulk soil**

Caption: $\Delta^{14}C$ of bulk soil and respired CO_2 by depth for each site in 2019. Error bars show one standard deviation for bulk soil, points show mean of three replicate profiles for bulk soils and single observations for respired CO_2 (still waiting for data from laboratory duplicates).

Fig. 7. Regression of 2019 bulk soil incubations and corresponding bulk soil $\Delta^{14}C$

Caption: Regressions of $\Delta^{14}C$ of bulk soil and respired CO_2 by depth for each site in 2019. Error bars show one standard deviation for bulk soil, points show mean of three replicate profiles for bulk soils and single observations for respired CO_2 (still waiting for data from laboratory duplicates).
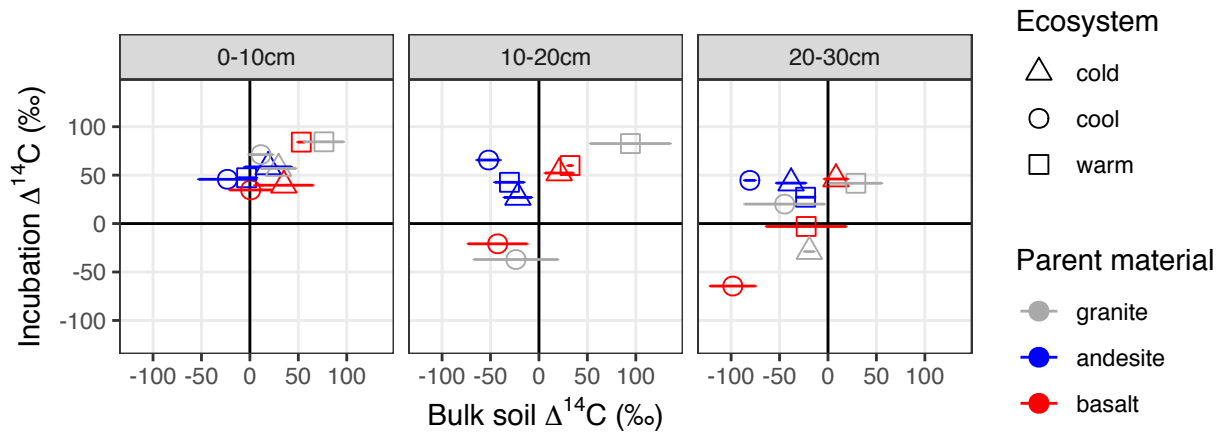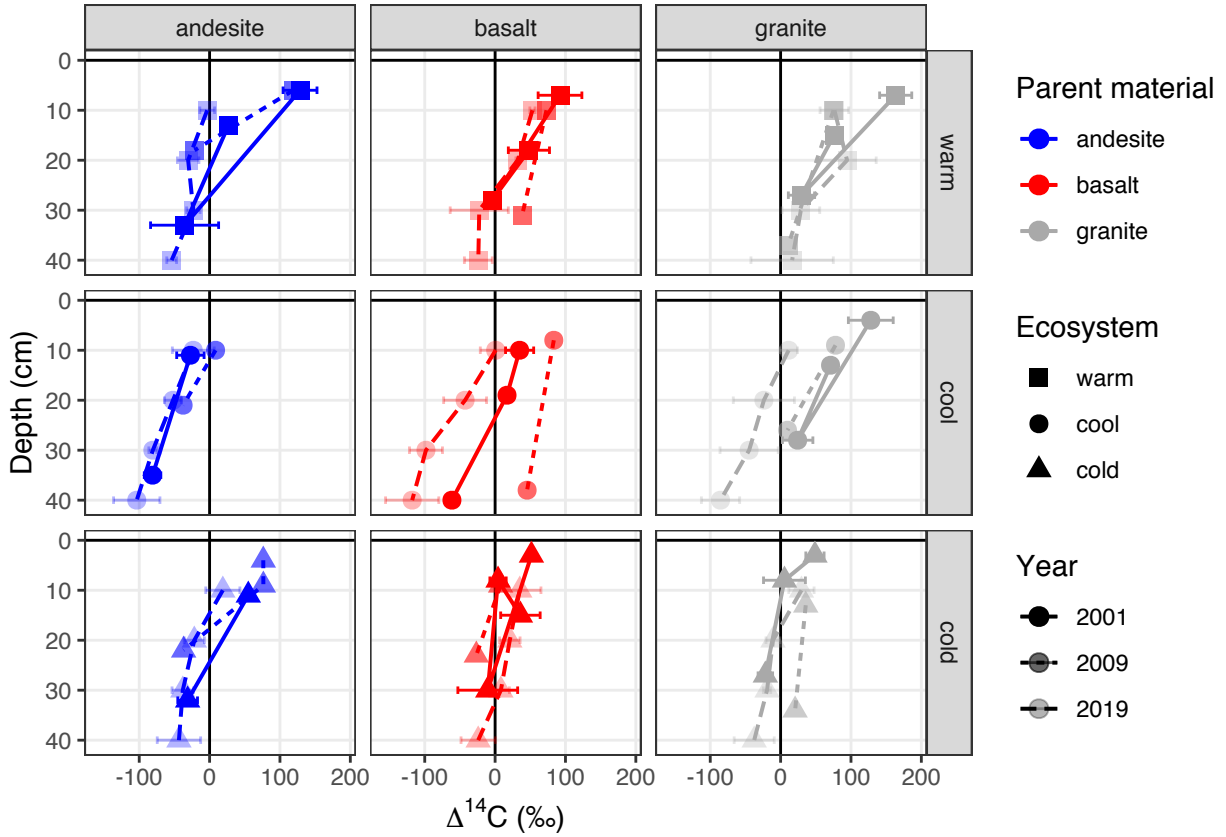
Time series: Δ^{14}C by depth (as measured)

Fig. 8. Time series of Δ^{14}C by depth, as measured

Caption: Points show mean of three profile replicates for 2001 and 2019 samples. Error bars show $\pm$ 1 standard deviation of the mean (only a single profile was analyzed in 2009).

Spline fitting

Fit splines to 2009 data to predict at 2001 depths

Soils collected in both the 2001 and 2009 sampling campaigns were sampled by horizon, but the depth intervals differed between the two sampling years. In 2009, full profiles were excavated for each site, as opposed to the shorter profiles collected in 2001 from the GR and AN sites. Radiocarbon was measured on all three replicate profiles at each site for the 2001 samples, but only for one of the replicate profiles at each site in 2009, e.g. ANpp rep2, etc.

In order to compare the radiocarbon profiles between 2001, 2009, and 2019 we interpolated both radiocarbon and carbon stock data at 1 cm intervals for each site in the 2009 and 2019 datasets, and then summed the carbon-stock-weighted radiocarbon values for each depth interval sampled in 2001. A monotonic cubic spline fit was used for the carbon stock interpolation (Wendt and Hauser 2013), and a mass-preserving spline was used to fit the radiocarbon data (Bishop, T.F.A., McBratney, A.B., Laslett, G.M., (1999) Modelling soil attribute depth functions with equal-area quadratic smoothing splines. Geoderma, 91(1-2): 27-45).
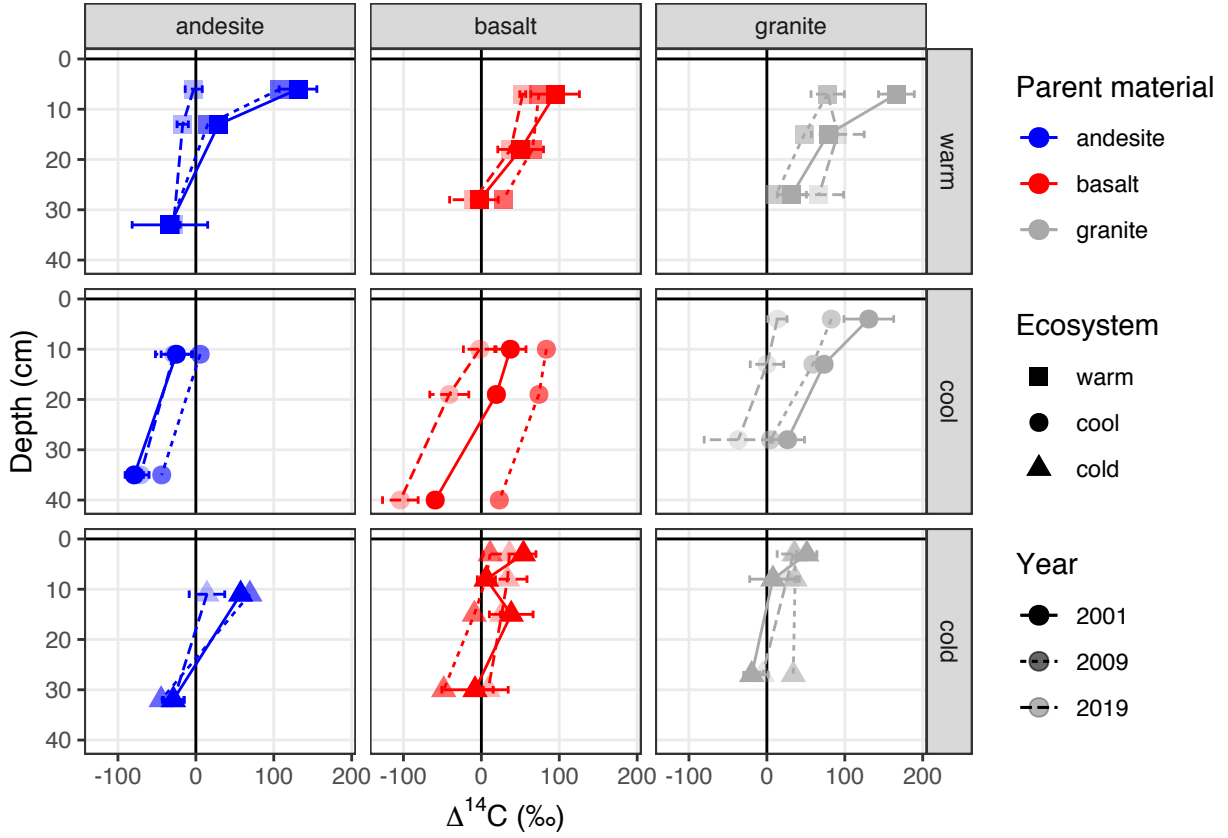
Fig. 9. Time series of Δ^{14}C by depth (2001, 2009, 2019)

Caption: Points for 2001 samples show the mean Δ^{14}C values at the measured depths. Points for 2009 and 2019 samples are spline-fitted estimates of Δ^{14}C predicted for the same depth intervals as measured in 2001. Error bars show $\pm$ 1 standard deviation of the mean of three replicate profiles for 2001 and 2019 samples (only a single profile was analyzed in 2009).