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Assessing the fidelity of leaf wax signals in marine sediments: n-alkane sensitivity to change along a precipitation gradient

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Leaf wax n-alkanes are well known higher plant biomarkers. These molecules are widely found in geological archives, where their concentration, average chain length (ACL) and isotopic composition ($\delta^{13}\text{C}_{\text{alkanes}}$ and $\delta^2\text{H}_{\text{alkanes}}$) serve as proxies for changes in continental vegetation and hydroclimate. While mechanistic relationships of these proxies with climate and vegetation are relatively well understood, little is known about the transport of those biomarkers into geological archives. In marine sedimentary records, leaf wax biomarkers are often interpreted to represent the contiguous continental catchments, but few studies have examined the fidelity with which n-alkanes in marine sediments record the corresponding continental conditions.

Here we assess the variability of n-alkane composition in terrestrial and marine sediments from 26°S to 41°S along the Chilean coast. The sample sites are located along a strong vegetation and precipitation gradient, with precipitation ranging from 25 to 2300 mm/yr. We evaluate riverbed sediments from twenty catchments, draining the western slopes of the Andes to the Pacific Ocean and compare the values to the ones of 19 samples from marine surface sediments recovered directly offshore each catchment.

The correspondence between terrestrial and marine n-alkanes signals changes along the precipitation gradient. Where precipitation rates range between 100 to 500 mm/yr, ACL and $\delta^2\text{H}_{\text{alkanes}}$ values agree well between continental and adjacent marine sediments. At precipitation rates below 100 mm/yr, ACL and $\delta^2\text{H}_{\text{alkanes}}$ values recorded in marine sediments are consistently lower than the ones found in continental sediments. At precipitation rates higher than 500 mm/yr, ACL and $\delta^2\text{H}_{\text{alkanes}}$ values registered in marine sediments are consistently higher than in the adjacent catchments.

Multiple factors, including mixing of sediment from different sources along the transport pathway from continent to ocean or variability in catchment storage capacity, likely cause marine n-alkane composition to be offset from their terrestrial source. Nevertheless, the consistent change in behavior along the gradient suggest that precipitation is the dominant factor on the transmission of n-alkane signals along the sedimentary routing systems of the study area. Moreover, since correspondence decreases at high and low precipitation, our data suggest that the sensitivity of

the leaf wax biomarker proxy in marine archives towards hydrological change may be subdued due to sedimentary integration. This may have implications for quantitative interpretations derived from n-alkanes and their isotopes in marine paleorecords.