

Greater average chain length of n-alkanes correlates with D-depletion and ^{13}C -enrichment in evergreen angiosperms in comparison with other higher plant species

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Several recent studies indicate that coexisting terrestrial higher plants with the same biosynthetic pathways but contrasting physiology may have significantly different D/H and $^{13}\text{C}/^{12}\text{C}$ compositions. Because the extent of these differences is of the same magnitude as the $\text{dD}/\text{d}^{13}\text{C}$ excursions displayed by sedimentary biomarkers, these findings deserve attention from palaeoclimatologists who need to find a reliable method for identifying shifts in the contribution of isotopically different plant species during periods of climate change. In order to identify such a method, we investigated $\text{dD}/\text{d}^{13}\text{C}$ values and average chain length (ACL) of leaf wax n-alkanes in modern open-air angiosperm and conifer species from northern England, UK. With the exception of *Juniper communis* ($\text{dD} = -123\text{‰}$, $\text{d}^{13}\text{C} = -30.8\text{‰}$), the n-C₂₉ alkane data from 12 higher plants show a negative trend between d^{13}C and dD values. The evergreen angiosperms (4 species, $\text{dD} -193$ to -164‰ ; $\text{d}^{13}\text{C} -32.7$ to -28.4‰) are clearly separated from the deciduous angiosperms (6 species, $\text{dD} -153$ to -130‰ ; $\text{d}^{13}\text{C} -39.5$ to -34.8‰), while the conifers (2 species, $\text{dD} -163$ to -147‰ , $\text{d}^{13}\text{C} -31.9$ to 30.6‰) are in the middle. The ACL values (n-C₂₃ to n-C₃₇ odd-chain-length alkanes) of the evergreen angiosperms (31.0-31.7) are all significantly greater than those of deciduous angiosperm (26.7-30.1) and conifer (27.4-28.0) species, *Juniper communis* again being an exception (32.6). It was previously suggested that the relative differences in dD and d^{13}C values of various coexisting plant types could potentially be explained by variations in stomatal conductance to H₂O and CO₂, so that species with lower conductances (in our case, evergreen angiosperms) would have D-depleted and ^{13}C -enriched values. Because a larger proportion of longer chain n-alkanes would lead to a more rigid leaf wax structure, greater occlusion of stomata and, as a result, reduced gas exchange, our findings that greater ACL values in evergreen angiosperms are associated with D-depleted and ^{13}C -enriched n-alkanes provide further support for this explanation. More significantly, however, this strong association between dD and d^{13}C values and molecular characteristics of individual biomarkers in modern plants would suggest a possible means for tracing the contribution of isotopically different plant species in the sedimentary record.