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Bulk stable light isotopic ratios in recent and archaeological resins: Towards detecting the transport of resins in antiquity?

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Modern and archaeological resins (known or suspected to have been transported in antiquity) have been analysed to determine whether hydrogen, carbon and oxygen isotopes can assist in pinpointing their geographical origin(s). Two case studies have been used: *Pistacia* sp. resin from Canaanite amphorae imported into Egypt from known geographical locations in the Eastern Mediterranean during the Late Bronze Age, and Roman amphorae sherds lined with *Pinaceae* sp. resin from sites ranging from Britain to the Eastern Mediterranean.

Our results show separate groupings between the two resin types (pinaceae and pistacia) and between the modern and archaeological resins. The modern resins have a wide range of isotopic values and vary within and between trees, with species, altitude and latitude. For δ^{13}C there is an offset between the modern and archaeological resins, which for pistacia resin is attributable to the burning of fossil fuels. But, an offset remains for the pinaceae resin. All the resins are significantly more depleted in hydrogen and enriched in oxygen compared with the global meteoric water line which is likely to be due to biosynthetic fractionation. In addition, the archaeological pistacia resins have a higher percentage oxygen content than their modern equivalents, whilst the archaeological pinaceae resins have approximately the same oxygen content. The archaeological resins also have δ^{18}O values similar to that of atmospheric O_2. This indicates that the archaeological resins are exchanging oxygen with the atmospheric (rather than local meteoric water), and the pistacia is gaining additional

atmospheric oxygen. The percentage hydrogen decreases between modern and archaeological resins for both resin types and there is a shift towards less negative δD values. It therefore seems likely that carbon bound hydrogen does exchange during diagenesis. These findings of low temperature oxidation and hydrogen exchange prevent the archaeological data being correlated to latitude.