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Deuterium isotopic exchangeability of resin and amber at low thermal stress under hydrous conditions

G. Gonzalez (1), R. Tappert (2), A.P Wolfe (1), and K. Muehlenbachs (1)

(1) University of Alberta, Earth and Atmospheric Sciences, Canada (ggonzale@ualberta.ca), (2) University of Innsbruck, Institute of Mineralogy and Petrography, Innsbruck, Austria

Hydrous deuterium-exchange experiments have shown that a significant fraction of the original D/H composition of bulk kerogens, bitumens and expelled oils may participate in isotopic exchange reactions during burial diagenesis. However, it is unknown to what extent plant-derived secondary metabolites, namely resins and their fossil counterpart amber, exchange hydrogen isotopes following their biosynthesis. This situation hinders the application of resin D/H measurements in paleoenvironmental reconstruction. Here, we assess explicitly hydrogen exchange in resins and ambers using a series of immersion experiments in deuterated (D-enriched) waters over a period of several months at several temperatures. We are especially interested in assessing whether significant H-isotopic exchange occurs between resins and meteoric waters during early thermal maturation and polymerization. At 90ºC, equivalent to $\sim$3km of burial in most diagenetic regimes, modern conifer and angiosperm resins have an average post-metabolic H exchange of 4.6%, compared to only 1.1% for mature, polymerized ambers. At 55ºC the degree of exchange is considerably lower: 1.9% for resins and 0.6% for ambers. These results indicate that most D/H isotopic exchange occurs prior to polymerization reactions, thereby confirming that D/H measurements from amber constitute a potentially sensitive proxy for environmental change.