

## **Differentiating Baltic and Bitterfeld ambers using multiple geochemical approaches: implications for the fossil record of amber inclusions**

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Baltic and Bitterfeld ambers are well known for their exquisite fossil inclusions, especially insects. Because of overarching similarities with respect to visual appearance, chemical composition, inclusion assemblage composition, and proximity to forests of the Paleogene Tethyan margin, these two ambers have not yet been differentiated definitively, leading to ongoing debate as to whether or not they are coeval. We combine FTIR, ToF-SIMS, and stable isotopic analyses ( $\delta^{13}\text{C}$  and  $\delta\text{D}$ ) to establish that Baltic and Bitterfeld ambers differ markedly in their geochemical properties, and are thus likely to represent distinct deposits in both space and time. Baltic amber has a greater succinate content relative to Bitterfeld amber, but less dehydroabietic acid. Although both ambers have  $\delta^{13}\text{C}$  (Baltic,  $-23.6\pm 1.0$ ,  $n=77$ ; Bitterfeld,  $-23.9\pm 1.7$ ,  $n=34$ ),  $\delta\text{D}$  is consistently depleted (by  $\sim 30\text{‰}$ ) in Baltic amber ( $-277\pm 22$ ) relative to Bitterfeld amber ( $-256\pm 9$ ), reflecting coherent paleolatitudinal differences between their respective source areas, that is, a diachronous northward shift of the pan-Tethyan catchment during the Paleogene. We surmise that the two deposits are geologically distinct despite taxonomic similarities between their respective arthropod records, with implications for improving our understanding of the temporal persistence of individual insect taxa.