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Marine-terrestrial analyses in the Iberian margin, intra-interglacial tree population crashes and atmospheric methane changes

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The Portuguese margin, where the combined effects of major river systems and a narrow continental shelf lead to the rapid delivery of terrestrial material, including pollen, to the deep-sea environment, has emerged as a critical area for linking marine and terrestrial records. Here we present results from foraminiferal oxygen isotope and pollen analyses and abundance of polar foraminifera from the interval 190-350 thousand years ago (ka) covering MIS 7-9, from core, MD01-2443 (37˚52.85'N, 10˚10.57'W, water depth 2925m). The record reveals a close overall correspondence between temperate tree pollen percentages and planktonic isotope values, on both millennial and orbital time scales. It also draws attention to a striking similarity between the temperate tree pollen curve and the record of atmospheric methane in terms of the timing and patterns of events (but not always amplitude). Of particular interest are tree population reductions observed at ∼333 ka and ∼237 ka, within MIS 9e and MIS 7e, respectively, occurring during plateaux in$\delta^{18}O_{benthic}$ values and not accompanied by changes in $\delta^{18}O_{planktonic}$. For the MIS 9e event, an increase in *N. pachyderma* (s) abundance is observed but this post-dates the drop in AP values, which suggests that a change in ocean circulation and sea surface temperatures was not the proximal

cause of the forest collapse. For the MIS 7e event, *N. pachyderma* (s) values remained low throughout. Comparison with other southern European sequences reveals coeval forest collapses in France, Italy and Greece. Within the uncertainties of our timescale, these events appear to be coeval with abrupt declines in atmospheric methane concentrations, following the early interglacial overshoots observed in the Vostok record. The important point here is that the record draws attention to abrupt events, occurring within interglacials and not accompanied by changes in ice volume or North Atlantic circulation. The origin of this variability is not clear, but it does not appear to represent a linear response to orbital changes. While the most prominent abrupt climate events have hitherto been usually associated with glacial climates, the above observations underscore the importance of understanding the origin of this intra-interglacial variability.