

Terrestrial plants $\delta^{13}\text{C}_{\text{org}}$ and environmental changes: two case studies from the Permian of northern Italy

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The late Paleozoic is a time characterized by several and significant environmental changes. In the last decades, analyses on terrestrial organic carbon proved to be useful for the investigation on past environmental changes and the related palaeoecological changes. Here we present two multidisciplinary case studies of two Permian floras from Italy. In both cases, taxon-specific geochemical analyses of organic carbon revealed significant environmental changes and allowed us to provide palaeoecological interpretations. The first case study is the Kungurian (Cisuralian, early Permian) flora of Tregiovo (northern Italy), where two rich plant assemblages were recovered from the same section. Both plant assemblages are characterized by the dominance of conifers, the presence of the same accessory taxa (e.g., sphenophytes, taeniopterids, seed ferns and ferns, ginkgophytes), but different relative abundances. The study on the $\delta^{13}\text{C}$ of bulk organic matter from the section shows a clear trend towards more negative $\delta^{13}\text{C}$ values. The $\delta^{13}\text{C}$ of organic carbon in specific conifer taxa shows the same negative trend, supporting the existence of an environmental change and a perturbation in the carbon cycle. The second case study is the Lopingian (late Permian) flora from Bletterbach (northern Italy), which includes several plant groups (e.g., sphenophytes, seed ferns, cycadophytes, ginkgophytes) and is dominated by conifers. The flora comes from few meters below a marine incursion documented along the section. Analyses carried out on the Bletterbach conifers yielded distinct taxon-specific $\delta^{13}\text{C}$ values, likely the consequence of living in different environments (e.g., coastal vs hinterland), suggesting also an adaptation to specific ecological niches.