Biomarker fingerprint of debris-flow deposits: a new proxy for last glacial IRD sources in the North Atlantic

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Investigating the spatio-temporal dynamics of the last glacial iceberg discharges constitutes a major challenge of paleoclimate research. Over the last decades, many ice-rafted debris (IRD)-provenance studies, mostly based on the comparison of the inorganic signature of IRD-rich layers and surrounding continental bedrocks, have mainly enabled to discriminate (sub-areas of) individual ice sheets as icebergs sources and to gauge their dynamic interplay. Diagnosis of specific source ice streams has nonetheless remained limited. Here we propose a new IRD-provenance methodology to refine iceberg sources. It combines a more sensitive approach (biomarker signature) and accurate IRD source archives (glacigenic debris flow – GDF – deposits). To test its potential, we analyse the organic composition (n-alkanes and chlorophyll-derived pigments) of sediments deposited within six major North Atlantic GDF depocenters fed by ice streams draining the surrounding ice sheets. The biomarker fingerprint of GDF deposits appears to (1) be consistent with a common origin with IRD through erosion of outcrops and transport by ice streams, (2) differ significantly from that of ambient hemipelagic sediments, (3) constitute, with this hemipelagic fingerprint, both end-members of the biomarker fingerprint of IRD-bearing marine sediments, (4) be specific and unique to each GDF depocenter, allowing to differentiate the corresponding specific ice streams, and (5) have remained homogeneous enough through the last glacial to use it as a proxy to refine the last glacial IRD-sources. The biomarker fingerprint of GDF deposits thus shows strong potential to track the specific source ice streams that delivered IRD in the last glacial North Atlantic.