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Origin of European alabaster artworks assessed through isotope fingerprinting (S, O, Sr).

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Gypsum and anhydrite alabaster ($CaSO_4.2H_2O$ and $CaSO_4$) has been used for artworks throughout history due to its fine-grained texture, pure white colour and its softness making it easy to work. Like for other types of artefacts, it may be crucial for art historians or museum conservators to correctly assign the provenance of the raw material in order to validate or invalidate hypotheses based on iconographic or stylistic comparisons. Alabaster characterisation could also help with forensic studies to eliminate and backtrack forgeries such as the "Assyrian" reliefs forged by Shaun Greenhalgh of Boulton early this Century (http://en.wikipedia.org/wiki/Shaun_Greenhalgh). Contrarily to marble artwork, only few studies addressed the mineralogical, geochemical and isotopic fingerprints of raw alabaster compared to those of alabaster sculptures (e.g. Costagliola *et al*., 2001, Ligeza *et al*. 2001). It has been shown that sulphur and oxygen isotopes of gypsum plaster can be used to trace its origin (Kloppmann *et al*., in press) and this combination of isotopes together with $^{87}Sr/^{86}Sr$ ratios was used in the present pilot study of isotope fingerprinting on French alabaster artworks. 8 samples of medieval and renaissance sculpture fragments of different provenance (Burgundy, Lorraine, Languedoc, Pyrenees) were analysed together with samples of ancient gypsum quarries from France (Jura, Alps, Provence, Burgundy, Lorraine), Spain (Aragon and Catalonia), England (Nottingham).

$\delta^{34}S$ values of all French samples from the Alps and the alpine foreland (Provence, Jura) fall in a narrow range of +15.6 to +16.9 ‰ *vs.* CDT, whereas $\delta^{18}O$ values are much more variable for this group (+2.8 to +13.3 ‰ *vs.* SMOW). Samples form Côte d'Or (F, Burgundy) and Sarral (E, Catalonia) plot in the same range. Catalan samples from Beuda are significantly enriched in ^{34}S with a $\delta^{34}S$ close to +21 ‰ whereas Spanish samples from Aragon and French samples from Lorraine are depleted in ^{34}S ($\delta^{34}S$ of +10 to +13.5 ‰). The only English sample of Chellaston gypsum (Nottinghamshire) falls slightly above the previously published range ($\delta^{34}S$ of +12 to +13.8 ‰ Taylor, 1983). $^{87}Sr/^{86}Sr$ ratios for raw alabaster vary significantly from 0.7076 to 0.7096 and allow discriminating French Alps alabaster *sensu lato* from the Nottingham alabaster with a much more radiogenic signature. The studied artwork from S France (Languedoc) shows clearly the Beuda (Catalonia) signature for all three isotope systematics as it was suspected on the basis of stylistic and historical analyses. English origin could be confirmed for a tombstone sculpture from N France and local origin is probable for the analysed artworks from Burgundy and Jura. The chosen combination of isotope tracers seems promising for forensic work on alabaster provenance in Europe but the database on samples from historical quarries needs to be enlarged to take into account the variability of raw materials from Europe and the Mediterranean basin.

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