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TECHNICAL INNOVATIONS AND SOCIO-ECONOMIC BEHAVIOURS IN THE UPPER SOLUTREAN. NEW DATA ON HEAT TREATMENT IN SOUTHWESTERN FRANCE

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The Upper Solutrean (24-23.5/23 ka cal BP) saw the development of a set of **specific and diversified hunting implements**. In the same time, **two new technical processes** appear: **pressure retouch** and the **heat treatment of silica rocks**. The latter **alters the mechanical properties of rocks** and may improve their **knapping quality** and the **sharpness** of the resulting artefacts.



Heat treatment has rarely been understood in its techno-economic context, its prevalence remains poorly assessed in France and the data available on it is still relatively scattered. We present here one aspect of a research project aiming to **understand the conditions of emergence and implementation of heat treatment** during in the Upper Solutrean in south-western France.

Characterising the heat treatment technique used by Solutrean groups is important for evaluating the level of **technical and economic complexity** related to its implementation.

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Heat treated shaping flakes from the C-E layer of the Piage deposit (Fajoles, Lot)

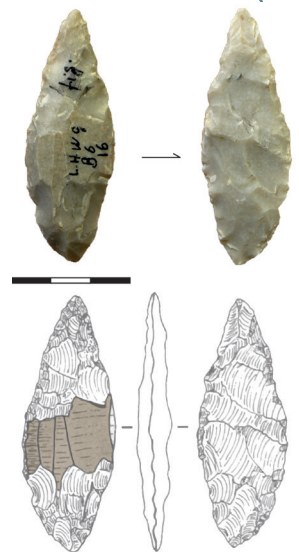
A

Macroscopic observations : heat treatment proxies

Reddening: caused by the oxidation of iron oxides and depends on their concentration.

Whitening of the surface: caused by internal microcracks related to the sudden evacuation of structural water, occurs at higher temperatures.

Gloss: results from the transformation of the mechanical properties of the material. Its recognition is easier when it is associated with **matt pre-heating removal scars** (i.e. gloss contrast). In this case, it's the **most reliable macroscopic criterion to identify a heat treatment on artefacts**.



Heat treated laurel leaf, Laugerie-Haute, Collins 1974, modified ; picture © J. Bachellerie.

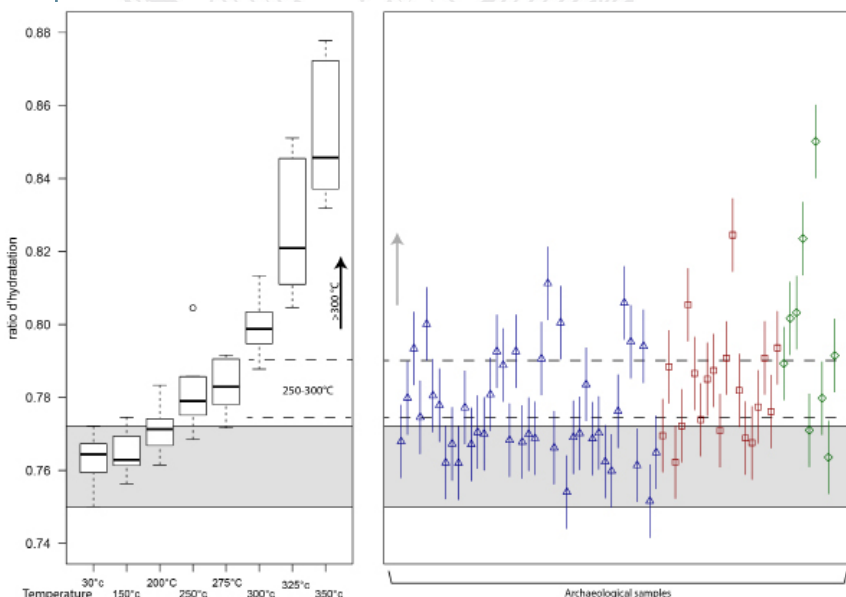
B

Determining heating temperatures

The applied **infrared spectroscopic analysis** is based on the assumption that the **heat-induced transformations of silica rocks** are caused by the **gradual disappearance of silanol (SiOH)**, causing a progressive **reduction of the network of intergranular pores** (for the detailed theoretical framework and mechanisms, see Schmidt et al. 2013).

First results for the solutrean of le Piage(Fajoles, Lot)

- Some of the analysed artefacts remain **indeterminate** because of the **overlap of values** produced by unheated artefacts and artefacts heated at low temperatures,
- Artefacts having produces unambiguous values (not affected by the overlap problem) indicate heating to a temperature range between 250° and 300°C. This pleads against the use of open-air fires for heating and in favour of a more controlled heating **process**.



Finally, although the conservation of the Solutrean level is not optimal at Le Piage, these results show that **only bifacial points** (in particular **laurel-leaf points**) were subjected to **intentional heat treatment**. On the other hand, the **rest of the hunting equipment** (i.e. **shouldered points**) **does not show the implementation of this technical process**.

How can we translate these facts into cultural choices? We will now try to answer this question from a broader corpus.

Comparison of the hydration ratios of the archaeological corpus (right) and the calibration series established from geological samples heated successively to 150, 200, 250, 275, 300 and 350°C (left).

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