



## **Press release – PLOS ONE**

### **An enigmatic 24,000-year-old stone artifact found in Vale da Pedra**

*In northeastern Brazil, the Franco-Brazilian Mission of Piauí has uncovered 2,200 stone artifacts dated around 24,000 years ago at Vale da Pedra Furada, an open-air site on the left bank of the Baixão da Pedra Furada valley. Among these artifacts, one of them is particularly exceptional. It is a silty sandstone plate that presents technical characteristics hitherto unknown in Paleo-American sites. This new finding adds important information about a human occupation during the Last Glacial Maximum (26500-19000 years), thus contradicting the commonly accepted theory of a post-glacial human occupation of South America.*

#### **Furada, Piauí, Brazil**

The Pleistocene site of Vale da Pedra Furada (Piauí, Brazil), excavated by the Franco-Brazilian Mission of Piauí since 2011, is currently the object of research that provides important results on the first human occupations in South America. The site is known to contain archaeological evidence of human occupation between 40,000 and 5,000 years ago. In 2016, archaeologists excavated an archaeological horizon containing 2,200 lithic artifacts. Radiocarbon analysis ( $^{14}\text{C}$ ) of the charcoals associated with these artifacts, as well as the analysis by OSL (Optically Stimulated Luminescence) of the sediments around the artifacts allowed the archaeological horizon to be dated to 27,600-4,000 years. All lithic artifacts were manufactured on quartz or quartzite, and present well-known characteristics in the region. However, one of them is distinguished by its exceptional character. It is a well cemented silty sandstone plate with a maximum length of 21.0 cm, a maximum width of 18.5 cm and a maximum thickness of 2.9 cm, on which the artisans knapped a hexagonal-shaped structure and symmetrical in its maximum length, with a macro-denticulation produced by large removals (extractions) in its periphery.

The technical-functional analysis of the knapping stigmata and the traceological analysis of the macroscopic use-wear traces reveal a technical conception focused on the configuration of double bevels and the production, in the same piece, of at least two successive artifacts with probably different functions. This piece presents an unambiguous anthropogenic character and reveals a technical novelty during the Pleistocene occupation of South America.

#### *A well-known technical background*

Throughout the entire stratigraphic sequence of Vale da Pedra Furada, there are fifteen different archaeological horizons, separated by sterile sedimentary layers. The artifacts

are mainly lithic specimens, due to the acidity of the soil. The traceological analysis carried out on a large number of artifacts shows the presence of cutting edges with and without retouching that were in contact with animal and vegetable matter (woody and non-woody plants). The predominant raw materials used throughout the sequence are quartz and quartzite. A third raw material, sandstone, is widely used in the oldest levels.

On the technical and morphological plane, several categories of tools can be distinguished. The predominant tools are three: the *rostrum* (delineation break to externalize a linear or micro-denticulate active part), the *bec* (delineation break to exteriorize a point less than 6 mm in length), and the *single bevel* (with a cutting edge that can take different functional characteristics). The toolkit, depending on the layer considered, can also contain: denticulates, scrapers, lateral scrapers, perforators and bifacial convergent tools.

With regard to the production modes, two are distinguished: debitage and shaping. In the case of debitage, two modalities are distinguished. The first is bipolar percussion, which is the most recognizable, but not the most common, except for the more recent Pleistocene levels. The second corresponds to the opening of a striking platform surface in order to produce a small series of 2 to 3 flakes. For its part, shaping is present in all archaeological horizons, but it is little represented in the oldest levels.

A third, very frequent mode of production is distinguished, where three technical principles interact: the selection of a pebble that has certain technical-functional criteria of the future tool, followed by a debitage phase that consists of the production of a very specific first removal (i.e. flake), which will open the shaping sequence, and which will allow to establish the missing functional criteria in each target tool. This flake, the product of the opening in a precise place on the pebble, will always be the same, and will be the privileged support for a large number of tools on flakes.

### *An exceptional artifact*

The artifact reported here was found in one of the 4 archaeological horizons identified in the C7 sedimentary ensemble (this same subdivided into 3 different sub-ensembles “ $\alpha$ ”, “ $\beta$ ” and “ $\gamma$ ”). This C7 ensemble is located between two sedimentary ensembles (C6 / C8), which do not present cultural remains.

The C7 $\gamma$  subset, with a depth of  $\sim 2.50$  m, has two archaeological horizons called “C7 $\gamma$ -a” and “C7 $\gamma$ -b”. The Bayesian chronological model, built on the basis of  $^{14}\text{C}$  dates, OSL dates and stratigraphic information places the C7 $\gamma$  sub-ensemble between 27,600 and 24,000 cal yr BP.

The archaeological horizon that concerns us in this article is C7 $\gamma$ -a, which, excavated in 6 m<sup>2</sup>, has provided 2,200 artifacts of more than 1 cm. One of these artifacts (N ° 255660), manufactured in a silty sandstone plate, has exceptional morphological and technical characteristics, which stand out in relation to all the stone assemblages of Vale da Pedra Furada.

Five stages of technical transformation indicate that this object corresponds to two successive projects. The first project is to obtain a hexagonal form on a 2.9 cm



thick plate of silty sandstone (maximum length: 21 cm, maximum width: 18.5 cm), through a shaping operation. Likewise, it was sought to create a peripheral double bevel opposite a blunt prehensive part. This prehensive part was the object of a previous shaping, giving it an appearance of an outgrowth, in the manner of a peduncle. The second project is a kind of denaturing of the first, that is to say a catachresis (a deviation from the first function), thus allowing it another functional destination. This transformation corresponds to a well-known tool called *rostrum* (break of the first denticulate delineation allowing a new linear edge).

If the intentional character of this artifact is incontestable, its function remains enigmatic. Perhaps it is a simple use object, or more likely it could be an object with a sign function. That would explain, at the same time, its uniqueness among the toolkit of the archaeological layer to which it belongs, and the fact that we have not found it in other layers of other sites. In any case, it is an exceptional discovery, since it is 24,000 years old. Data reported for all periods and regions in South America do not authorize a direct comparison in terms of function and use. Current data shows that this artifact is one of the oldest, if not the oldest, resulting from bifacial production in South America.

When we examine the Holocene industries, it would be possible to evoke shovels, hoes, etc. However, these tools were generally manufactured on hard rocks (basalts, andesites and dacites) resistant to impacts, or, more rarely, on metamorphic or hard sedimentary rocks. These artifacts generally show typical signs of wear and impact on the part directly in contact with the material to be transformed, which is not the case of the artifact presented here.

This artifact confirms the existence of human occupations 24,000 years ago in South America. These populations possessed a highly varied toolkits, reflecting a rich and diversified material culture, like any other human society.

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