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Palaeoenvironment and dating of the Early Acheulean localities from the Somme River basin (Northern France): New discoveries from the High Terrace at Abbeville-Carrière Carpentier

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ABSTRACT

Dating the earliest human occupations in Western Europe and reconstructing links with climatic and environmental constraints is a central issue in Quaternary studies. Amongst the discovery of Palaeolithic artefacts ascribed to the Early Pleistocene in southeast Britain and central France the Somme Basin, where the Acheulean type-site Amiens Saint-Acheul is located, is a key area for addressing this topic. Research undertaken over the past 20 years on both Quaternary fluvial and loess sequences of this area has provided a unique dataset for the study of the relations between human occupations and environmental variations. Studies based on an interdisciplinary approach combining sedimentology, palaeontology and geochronology have highlighted the impact of the 100 kyrs cycles on terrace formation during the last million years. In this terrace system, the earliest *in situ* Acheulean settlements known in the 1990s were dated to early MIS 12 (±450 ka), but new field discoveries, at Amiens "Rue du Manège", dated to ± 550 ka, significantly increase the age of the oldest human occupation in the area. In this context, new fieldwork has been undertaken in Abbeville at the Carrière Carpentier site, famous for its White Marl deposit attributed to the Cromerian and in the same terrace level where the former discoveries of "Abbevillian bifaces" were made by d'Ault du Mesnil. This research is based on an interdisciplinary approach, combining sedimentology, paleontology, dating (ESR on quartz and ESR/U-series on teeth) and archaeology. According to the various bio-proxies (molluscs, large vertebrates, small mammals), the White Marl was deposited during the early part of an interglacial phase in an aquatic slow-flowing environment, as emphasized by the development of oncoliths and the presence of fish and aquatic molluscs. The landscape was composed of a mosaic of open bush and forest areas, in which wet

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and grassy vegetation developed on riverbanks. On the basis of terrace stratigraphy, ESR and ESR/U-series dating results, and biostratigraphic data, the fluvial deposits of the White Marl can be securely attributed to MIS 15. In addition, some Acheulean bifaces were discovered at the base of the slope deposits, directly overlying the fluvial sequence. These artefacts are most likely coeval with the end of MIS 15 or an early stage of MIS 14, between 550 and 500 ka, and represent, together with the artefacts from Amiens "Rue du Manège", the oldest *in situ* evidence of Acheulean occupation in Northern France. However, no unquestionable artefacts have been discovered in the White Marl or in the underlying gravel layer. These discoveries contribute to the chronology of the earliest evidence of hominin occupations in north-western Europe which may be related to *Homo heidelbergensis*.

1. Introduction

The Quaternary deposits of the Somme Valley have been known since the middle of 19th century for their rich Palaeolithic localities (Boucher de Perthes, 1847; Prestwich, 1860; Commont, 1910a,b; Breuil, 1934; Breuil et al., 1939a,b; Agache et al., 1963; Bourdier, 1969, 1974a,b; Bourdier and Lautridou, 1974; Haesaerts et al., 1984; Lautridou, 1985; Lautridou et al., 1999; Haesaerts and Dupuis, 1986; Sommé et al., 1984; Antoine, 1994; Antoine and Tuffreau, 1993; Tuffreau and Antoine, 1995). The Abbevillian lithic "culture", considered as Early Acheulean, was first described at Abbeville after the crudely-shaped bifaces found there (Breuil, 1932). These discoveries contributed to discussions focusing on the onset of bifacial technology during the 20th century and were included in the technological schemes published by Breuil and other prehistorians.

The Somme Valley is also known for its stepped fluvial terrace system incised into Upper Cretaceous Chalk and protected by a well-developed loess-palaeosol cover reaching thicknesses of up to 10 m (Antoine, 1994; Antoine et al., 2003, 2007). In this area, the Cretaceous Chalk bedrock is extremely rich in flint, which undoubtedly influenced the high density of Palaeolithic sites that characterises this region. During periods of low sea level, which prevailed during most of the Pleistocene, the present-day Somme Basin was located at a considerable distance upstream of the Palaeo-Somme fluvial system, which was at that time a tributary of the Channel River (Auffret et al., 1982; Gibbard, 1988, 1994; Lericolais et al., 2003) (Fig. 1).

Research undertaken over the past 20 years on the fluvial terraces and loess sequences of the Somme Basin and on interactions between human settlement and environmental change are based on an interdisciplinary approach to Quaternary sequences and associated Palaeolithic settlements (Antoine et al., 2000, 2003, 2006, 2007, 2010). These studies, mainly performed on fluvial formations, have highlighted the impact of cyclic climatic changes on sedimentation and river morphology, and in particular, the role of 100 kyr climatic cycles for the last million years (stepped terrace formations) (Antoine et al., 2007). Moreover, they situate the numerous deposits of the Somme basin and surrounding areas within a global regional chronological framework, and enable us to propose a detailed history of the evolution of valleys and to address the relationship between hominins and the environment (chronoclimatic context, palaeotopography, sources of raw material...) (Antoine et al., 2003, 2006, 2015a,b).

In the Somme Basin, results from modern excavations conducted in the 1980s (Tuffreau, 1980, 1989; Tuffreau et al., 1982), combined with geochronological data (ESR and combined ESR-U-series, Laurent et al., 1994; 1998, Bahain et al., 2002, 2007) and palaeoenvironmental studies (Munaut, 1988, 1989; Limondin-Lozouet and Antoine, 2006) show that the first *in situ* and well dated human occupations in the area go back to about 450 ka (Early MIS 12, Cagny la Garenne II), and that they are represented by advanced Acheulean industries (Antoine et al., 2010). Acheulean bifaces were formerly found in the gravels of the Fréville Formation in Amiens (Commont, 1909a,b) and at the Moulin Quignon site in Abbeville (Aufrère, 1937; Breuil et al., 1939b), but their exact stratigraphic location is still difficult to establish. In contrast, the highest terraces of the Somme River system, such as the fluvial deposits of the Grâce-Autoroute Formation (Antoine et al., 2003), dated to approximately 1 Ma (Bahain et al., 2007), have yielded no Palaeolithic artefacts. In the context of new discoveries in central France (Despriée et al., 2011; Moncel et al., 2013, in press) and in the south and east of the United Kingdom (Parfitt et al., 2005, 2010), this probably indicates that the earliest human occupation of north-west Europe goes back to the beginning of the Middle Pleistocene. This question is of considerable importance for understanding the first human settlement of the valley and the chronology of occupations in Northern European latitudes. Indeed, during the Cromerian Complex (MIS 21–13 according to Cohen and Gibbard, 2011, or MIS 19–13 according to Preece and Parfitt, 2012), the river valleys from the south side of the Channel, such as the Somme, represented major migration routes during glacial periods with low sea level. During this long period, Acheulean occupations contained within the alluvial deposits are contemporaneous of the younger part of the Cromerian Complex (±500–650 ka).

However, intensive field research on the oldest part of the terrace system of the Somme Basin during the past 20 years has shown that these deposits, formerly exposed in old quarries in Amiens and Abbeville (Commont, 1909a,b; 1910a,b, Bourdier, 1969; Tuffreau, 1980, 1989), were poorly preserved (Antoine, 1990, 1997). In the light of these results, and despite the numerous test-pits made since the 1990s by rescue archaeology teams, it is extremely difficult to document new *in situ* Acheulean sites dating from the early Middle Pleistocene in the Somme Valley. For a long time the Acheulean site of Cagny-la-Garenne, excavated by Tuffreau in 1985–1986 and dated to the MIS 12 Early-Glacial, around 450 ka, was thus the oldest *in situ* evidence of Acheulean occupation in the area (Tuffreau, 1989; Antoine et al., 2010). Recently, the dating of the "Rue du Manège" site to 550 ka attests to the antiquity of hominin presence in the Somme Valley (Locht et al., 2013; Antoine et al., 2015a).

Preliminary results from research on the Abbeville Carrière Carpentier site were included in a recent paper on the earliest human occupations in the fluvial terraces of the Somme Basin (Antoine et al., 2015a,b). Here, we present new results concerning bioproxies (molluscs, large and small mammals), dating (ESR on fluvial quartz and ESR/U-series on teeth) and the archaeological evidence from the reference sites of the alluvial formation of Carrières Carpentier and Léon (2011–2014). These data are considered from the perspective of the expansion of the earliest Acheulean in Western Europe.