

Confirmation of Neanderthal/modern human interstratification at the Chatelperronian type-site

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The nature of the replacement of Neanderthal by anatomically and behaviorally modern populations in Europe is currently a topic of lively debate in human evolution. In an earlier paper [Gravina B, Mellars P, Bronk Ramsey C (2005) *Nature* 433:51–56], we published a series of radiocarbon accelerator mass spectrometer measurements for the site of Châtelperron in central France, which had been claimed to show a clear “interstratification” of successive levels of Neanderthal and modern human occupation, on the basis of excavations carried out by Henri Delporte in the 1950s. This interpretation has recently been challenged by Zilhão and colleagues [Zilhão J, d’Errico F, Bordes J-G, Lenoble A, Texier J-P, Rigaud J-P (2006) *Proc Natl Acad Sci USA* 103:12643–12648], who suggest that the deposits excavated in the 1950s consisted largely, if not entirely, of the unstratified “backdirt” of the earlier, 19th century excavations on the site. We show here that the excavation backdirt interpretation for the Châtelperron stratigraphy can be refuted from many different aspects of the stratigraphic, radiocarbon, and archaeological evidence. We reassess the significance of this site for current models of the coexistence and interactions between Neanderthal and anatomically modern populations in western Europe.

archaeology | Paleolithic | human evolution | France

In a paper published in *Nature* in September 2005 (1), we reported a series of 13 radiocarbon accelerator mass spectrometer measurements carried out on what the late Henri Delporte had described as a clearly interstratified sequence of Chatelperronian and Aurignacian levels at the French type-site of the Chatelperronian at the Grotte des Fées de Châtelperron in the Allier Department of east-central France (2–7). We regarded this as an important discovery, as there is now widespread agreement that the Chatelperronian industries were produced by the final Neanderthal populations in western Europe, whereas the classic “Aurignacian” technologies were products of the earliest, intrusive populations of anatomically and behaviorally modern humans. Although apparent interstratifications of Chatelperronian and Aurignacian occupations had previously been reported from three other sites in southern France and northern Spain (Roc-de-Combe, Le Piage, and El Pendo), the stratigraphic integrity of all of these sequences has since been questioned (8, 9), making this seemingly well defined sequence at Châtelperron itself of particular importance to current studies of potential coexistence and interaction between late Neanderthal and early anatomically modern human populations in Europe.

In view of the controversy generated by earlier reports of Neanderthal/modern human interstratifications (8, 9), we were prepared for some spirited reactions from some colleagues to the publication of the Châtelperron material. These duly materialized, first in a paper presented by Francesco d’Errico, João Zilhão, and two colleagues to the Annual Meeting of the Palaeoanthropology Society in Puerto Rico in April 2006[§], and subsequently in the printed version of this paper published in PNAS in August 2006 (10). The precise basis for the rejection of the Châtelperron sequence changed between the two versions of this paper. In the

published abstract of their Palaeoanthropology Society paper, d’Errico *et al.* asserted: “We conclude that at least Châtelperron levels B1–B3, and in all likelihood the entire B1–B5 sequence, represent reworked sediments and archaeological material, probably backdirt from the excavations conducted on the site in the nineteenth century.” In the version of the paper subsequently published in PNAS, this assertion was changed to the hypothesis that the material from the basal Chatelperronian levels (Delporte’s levels B4 and B5) was in fact almost certainly *in situ* and that only the material from the overlying, upper Chatelperronian levels (levels B1–B3) should now be interpreted as a 19th century “backdirt” accumulation (10). Delporte had reported that the thin, interstratified lens of Aurignacian occupation occurred within his level B4, intercalated between the rich levels of underlying (B5) and overlying (B1–B3) Chatelperronian occupations (2–7).

Clearly, this attempted refutation of the reported stratigraphy at Châtelperron has important implications for our understanding of the chronological and demographic relationships between the late Neanderthal and earliest anatomically modern populations in Europe, and it needs to be fully addressed. Fortunately, the suggestion that the greater part of the stratigraphic sequence at Châtelperron represents not *in situ* Chatelperronian occupations but simply the unstructured backdirt of the 19th century excavations on the site has a number of clear and explicit testable implications, which can be evaluated against several different aspects of the stratigraphic and archaeological data, both those recorded in the successive publications by Delporte himself (2–7) and those derived from our own studies and those of Zilhão *et al.* (10) on the collections from Châtelperron kept in the National Museum of Archaeology at St. Germain-en-Laye (Paris). Briefly, our conclusion is that the Zilhão *et al.* “backdirt” hypothesis for Delporte’s recorded stratigraphy can be decisively refuted on at least six or seven different grounds. For simplicity, our analysis follows the different aspects of the material as discussed in the paper by Zilhão *et al.* (10).

Fauna, Geology, and Taphonomy

In their analysis, Zilhão *et al.* lay great emphasis on the character of the faunal material recovered during Delporte’s excavations, and in particular on the high frequencies of carnivore remains (together with bones clearly modified by carnivores) throughout the various levels in the stratigraphic section. This is not a new observation and was noted by Jean Bouchud (11) in his original analysis of the Châtelperron fauna. As Zilhão *et al.* (10) clearly recognize, this fact alone has virtually no bearing whatever on the basic stratigraphic integrity or otherwise of the sequence described by Delporte. As

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[§]d’Errico, F., Bordes, J.-G., Lenoble, A., Zilhão, J., Annual Meeting of the Palaeoanthropology Society, Puerto Rico, April 2006, p. A95.

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Fig. 1. Photograph of the south and west faces of Delporte's "box" section excavated along the southern edge of the site. Note the contrast between the very loose appearance of the deposits, with many protruding roots, exposed in the western (i.e., right-hand-side) section of the deposits and the much more consolidated appearance of the deposits, with no visible roots, exposed in the adjacent, southern face. These confirm Delporte's observation that the easternmost limits of the 19th century excavations extended for a short distance into the western part of the box section (see Fig. 2). Composite image was compiled by F. d'Errico from photographs in the Museum of National Archaeology, St. Germain-en-Laye (Paris), and is reproduced with permission.

they correctly point out (ref. 10, p. 12644), in "western European cave sites of this time range, most archeological levels are palimpsests of alternating uses of the same place by two kinds of bone-accumulating agents, humans and carnivores." Even if carnivore activity could have caused some localized disturbance within the individual levels in the Châtelperron sequence, the mere presence of carnivores is effectively irrelevant to the overall integrity of the stratigraphic and archaeological sequence in the site as a whole. The relevance of this observation for the interpretation of the radiocarbon dates for the site is discussed further below.

Their observations on the geology of the deposits are equally puzzling. Because their study makes only a passing reference to the stratigraphic sequence actually recorded (and repeatedly illustrated) by Delporte himself, and because no deposits are currently available for study at the site itself, it is clear that their observations are based almost entirely on the small section of the deposits shown in the photograph from Delporte's excavations reproduced in their figure 1 (which we discuss further below) (see Fig. 1). How on this slender evidence it is possible to assert that this section makes "it clear that there is little or no bedding" except for "small lenses of limestone gravels and pebbles" and then to interpret this as a "crudely bedded . . . brown stony clay" involving "runoff and mud-flow . . . debris flow, and turf-banked solifluxion" (10, p. 12644) is difficult to comprehend. It is also difficult to perceive how a series of thin occupation horizons marked by varying degrees of reddening of the sediments (which Delporte describes as the major features of this section: see below) could be expected to show up in a small, poor-quality black-and-white photograph of an evidently uncleaned stratigraphic section. One would not normally expect to see such a radical stratigraphic and geological reinterpretation of an archaeological site based on such slender (photographic) evidence.

The observations on the taphonomy of the artefacts recovered from the different levels of Delporte's section are potentially more interesting. According to the analyses of Zilhão *et al.*, there is a seven-fold increase in the frequencies of "surface weathered"

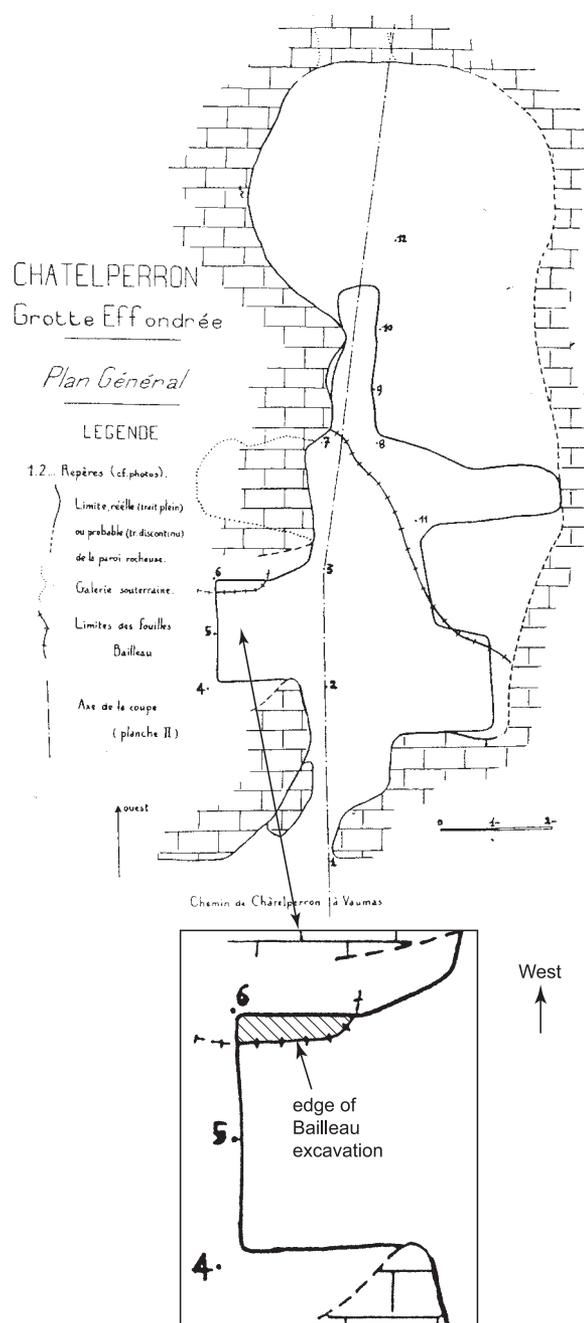


Fig. 2. Plan of Delporte's excavations at Châtelperron, showing the limits of the 19th century excavations by Bailleau (marked by + symbols) as reproduced in Delporte (ref. 4, figure 1, and ref. 5, figure 1). Note the overlap of the 19th century excavations into the western edge of Delporte's "box" section shown in SI Figs. 4 and 5. (See also Fig. 1.)

(presumably patinated) artefacts between the lower (B4–B5) and upper (B1–B3) levels of the sequence, together with a three-fold increase in the frequencies of broken pieces (figure 2 in ref. 11). Why the much higher frequency of "surface weathered" pieces in the upper as opposed to lower levels should favor the backdirt interpretation is again unclear to us, because according to the backdirt model all of these pieces must derive directly from the underlying (much less patinated) Chatelperronian material in levels B4 and B5, which were subsequently dumped on top of the *in situ* B4 and B5 levels in the course of the 19th century excavations, only 80 years before the time of Delporte's excavations. How the lithic

artefacts in levels B1–B3 could have acquired this greatly increased “surface alteration” in the 80 years between the 1870s excavations and those of Delporte in the 1950s remains unexplained. The increased frequency of broken pieces in these upper levels would no doubt be consistent with the backdirt model but of course could be equally well explained by a variety of other taphonomic factors operating on essentially *in situ* deposits, including, for example, a higher impact of human trampling (or carnivore disturbance) during the formation of these upper levels, the effects of other postdepositional pressures deriving from the modern surface over the past 35,000 years, the increased fragility of these more heavily “weathered” artefacts in the upper levels, or conceivably the effects of tree-root action deriving from the modern (tree-covered) surface. Once again we fail to see how any of these observations can be taken as any kind of support for the backdirt interpretation, as opposed to the interpretation of these levels as essentially primary occupation deposits, as Delporte (2–7) consistently maintained. The greater degree of patination of the pieces in the upper levels could also be attributed to a variety of purely *in situ* processes, including their greater exposure to chemical weathering processes in these upper levels (only 20–80 cm below the modern surface) or alternatively to changes in the climatic and associated geochemical processes to which the artefacts were exposed during the successive stages of the accumulation of the deposits. But in either event, the increased surface weathering of the pieces in the upper levels is strongly opposed to the recent backdirt derivation of these pieces from the immediately underlying, basal Chatelperronian levels.

Photographic Evidence

The photograph of Delporte’s excavation reproduced by Zilhão *et al.* (10) to support their interpretations (see Fig. 1) merits closer examination. As they point out, this is a “mosaic” composition compiled by the authors from two or three small photographs in the archives of the St. Germain-en-Laye museum. Despite the absence of any labeling in the museum archives, this is clearly a photograph of the western end of the 2 × 2 m “box section” excavated by Delporte on the southern side of his main east–west section, as shown in the plans and sections of Delporte’s excavations reproduced here as Fig. 2 and supporting information (SI) Figs. 4 and 5. It goes without saying that this is hardly a model of archaeological photography, and it was presumably taken by Delporte (or one of his coworkers) as a rapid “snapshot” view of this trench at one particular point in the excavations, without any attempt to clean-up the section (for example by the removal of protruding roots), and was clearly not for publication purposes. Nevertheless, one point that emerges very clearly from the photograph is the marked contrast between the very loose appearance of the deposits, with large numbers of long protruding roots, in the western (i.e., right-hand) face of the section and the much more consolidated appearance of the deposits, with no visible roots, in the adjacent southern face. Zilhão *et al.* evidently interpret this photograph as demonstrating that the whole of the deposits in this box section represent the loose, unstratified infill of the 19th century excavations. However, a close examination of the site plan of the excavated areas provided in two of Delporte’s publications (4, 5) provides an immediate explanation for this observation. As shown in Fig. 2, Delporte recorded that the eastern limit of the 19th century excavations overlapped for a short distance (*ca.* 30 cm) into the western end of this box section. This observation of course would imply that the deposits eventually exposed by Delporte in the western face of this section, marked by a dense mass of protruding roots, does indeed represent the loose backdirt of the earlier excavations, whereas the section exposed in the immediately adjacent southern face (partially shown on the left-hand side of the photograph, and with no visible protruding roots) represents the *in situ* occupation levels, as clearly recorded in Delporte’s drawn sections (see SI Figs. 4 and 5). (We are

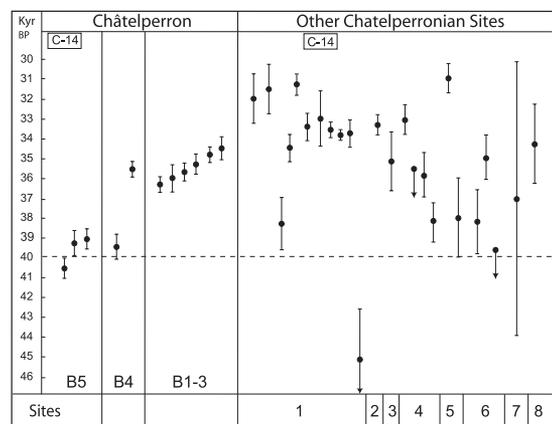


Fig. 3. Distribution of radiocarbon measurements on bone samples from levels B5, B4, and B1–B3 of Delporte’s excavations, compared with those for other Chatelperronian sites in France. Note that the two samples from level B4 group, respectively, with those from the underlying (B5) and overlying (B1–B3) levels, indicating a major depositional hiatus in this part of the sequence. For details of the sites, see ref. 1.

assuming here that roots would be likely to penetrate much more deeply in recent, loose “infill” deposits than into the much more compacted sediments in the *in situ* parts of the deposits.) This of course would presumably imply that the drawn section of this trench was recorded by Delporte before the extension of the excavation into the overlap zone with the 19th century excavations. Even allowing for the poor quality of this small, black-and-white photograph, we see this as providing explicit support for Delporte’s accurate identification of the spatial limits of the 19th century excavations, and as directly contradicting the interpretation of the whole of this section as representing the unstratified backdirt of the earlier excavations. Ironically, this crucial piece of evidence that Zilhão *et al.* illustrate in support of their backdirt hypothesis demonstrates exactly the reverse of their interpretation.

Radiocarbon Dating

The most direct and explicit support for the coherence and integrity of the stratigraphic sequence recorded by Delporte at Châtelperron is provided by the sequence of 13 radiocarbon dates we secured on individual bone samples collected from the different levels of his stratigraphic section (1). These were based on samples clearly marked in the museum collections as deriving, respectively, from levels B5, B4, and B1–B3 (combined) of Delporte’s section. As will be seen from Fig. 3, the dates fall into three groups that correspond closely with the recorded stratigraphic position of the samples (i.e., three closely similar dates ranging from $40,650 \pm 600$ BP to $39,150 \pm 600$ for level B5 at the base of the Chatelperronian sequence; seven individual dates that cluster between $36,340 \pm 320$ BP and $34,550 \pm 500$ BP for the combined levels B1–B3 in the upper part of the sequence; and two dates of $39,780 \pm 390$ BP and $35,540 \pm 280$ BP for the intervening level B4, which group respectively with those from the immediately underlying and overlying levels, clearly indicating the existence of a major depositional hiatus during the formation of this level). As a reflection of internal consistency and coherence between measured radiocarbon ages and the documented stratigraphic position of the samples, the results of the radiocarbon dating could hardly be more impressive.

We fail to see any way in which these dates can be reconciled with the hypothesis that much if not the whole of this stratigraphic sequence represents the unstratified backdirt of the 19th century excavations. The striking consistency (with one notable exception, discussed below) of the eight dates secured for the upper Chatelp-

erronian levels (B1–B3) is particularly significant. Apart from their internal consistency, why is it that not one of these samples produced a date in the range of 39,000–40,000 BP, which one would inevitably expect if these samples derived from the excavation backdirt of the underlying, *in situ* Chatelperronian levels in layers B4 and B5? Whichever way the radiocarbon evidence is interpreted, it poses massive and insuperable problems for either version of the two backdirt hypotheses advanced in d’Errico and Zilhão’s successive publications.

As Zilhão *et al.* (10) hasten to point out, it is true that one of the dated samples from levels B1–B3 produced a grossly aberrant date of >53,900 BP, clearly representing a bone fragment derived in some way from the basal Mousterian levels on the site. Interestingly, this is the only sample that showed any signs of carnivore modification. But as we pointed out in our original paper, there are at least three different ways in which this single aberrant result could be explained: (i) that it represents an isolated bone sample derived from the uppermost level of Delporte’s section (level A, which he described as containing both the modern soil together with some true “backdirt” material from the 19th century excavations) and was inadvertently included in the material from the immediately underlying levels B1–B3 during Delporte’s excavations; (ii) that this represents a sample genuinely recovered from the basal Mousterian levels but wrongly labeled or bagged-up at the time of the excavations (not an infrequent occurrence on archaeological excavations); or (iii) that it reflects simply the subsequent mixing of material during the course of repeated examinations of the Châtelperron collections in the St. Germain-en-Laye museum by a succession of different workers over the past 50 years (ref. 1, p. 55). In view of the fact that the bags of faunal material in the museum collections remained open and unsealed at the time of our collection of the samples in 2004, it is perhaps surprising that no further mixing of this kind occurred. But to use this one aberrant date as a proof that the entire sequence of Delporte’s levels B1–B3 represents a recent backdirt accumulation would seem to be pushing scientific credibility to its limits. One might perhaps add that the dates ranging between *ca.* 36,500 and 34,500 BP secured for the seven samples from levels B1–B3 are exactly what one might anticipate for a sequence of later Chatelperronian levels, as reflected in the dating of other Chatelperronian levels in French sites (see Fig. 3).

Lithic Artefacts

The discussion by Zilhão *et al.* of the lithic artefacts has already been partially dealt with in our preceding comments. We showed that the greater degree of fragmentation of pieces in the upper levels (B1–B3) can be readily accounted for by either contemporaneous or postdepositional processes acting on essentially *in situ* deposits, and that the much greater degree of patination of the pieces in these levels seems impossible to reconcile with any version of the 19th century backdirt hypotheses.

Their other observations on the lithic material pose similar problems. The most striking problem perhaps stems from the high frequencies of retouched implements recovered from Delporte’s levels B1–B3, including (according to Zilhão *et al.*) at least 112 retouched pieces and [according to the earlier analysis by Delporte (6)] at least 76 formally retouched tools, at least 19 of which were specimens of Châtelperron points and closely related backed or truncated forms. This raises the obvious question of why so many retouched pieces were overlooked during the 19th century excavations only to find their way into the discarded backdirt deposits. Zilhão *et al.* (table 4 of ref. 10) show that the proportion of retouched to unretouched pieces is actually somewhat higher in the upper (supposedly backdirt) levels than in the lower, hypothetically *in situ*, occupation deposits (i.e., 35% as opposed to 30% of the total artefacts). A similar observation could be made about the large numbers of identifiable faunal remains recovered from these upper levels, comprising according to Bouchud’s (12) analysis a total of at least 65 identifiable faunal specimens, including at least 29 speci-

mens of large taxa such as rhinoceros, bovids, bear, and horse. This observation prompts the question: what exactly were the 19th century excavators looking for in their excavations, if not retouched stone tools and relatively large, identifiable faunal remains?

In their analysis of the lithic material, Zilhão *et al.* place great emphasis on two particular pieces recovered during Delporte’s excavations: a claimed fragment of a Solutrian bifacial leaf-point apparently recovered from his level B2 and a supposedly diagnostic late Aurignacian (“Aurignacian II”) Dufour bladelet from his level B4. As regards the fragmentary Solutrian piece, we note that Delporte never mentioned or illustrated this piece in his own meticulous analysis of the lithic material (6), and that Zilhão *et al.* provide no illustration of this supposedly crucial piece in their paper. We understand that this is in fact a very small fragment that was initially identified merely as “possibly” Solutrian before this crucial qualification was deleted from the published version of the paper. Even if this were a Solutrian piece and it did derive from level B2, only ≈30 cm below the modern topsoil there are several widely recognized taphonomic processes by which a single small artifact of this kind could move vertically through a distance of ≈30 cm, as documented for example by refitting studies at the site of das Geissenklösterle (12) and elsewhere [a mechanism which Zilhão and d’Errico have frequently invoked in their interpretations of other early Upper Palaeolithic sites in Europe (13, 14)].

We are equally unconvinced by their interpretation of the small, retouched Dufour bladelet from level B4 as a diagnostically “Aurignacian II” artifact (see figure 2i of ref. 10). Although we do not doubt that broadly similar pieces [although generally much more “twisted” in profile (15, 16)] can be paralleled in some later Aurignacian industries, we understand from R. White and L. Chiotti that a number of closely similar if not identical pieces have been recovered from the recent excavations in the classically early Aurignacian (Aurignacian I) levels at the site of Abri Castanet, in this case dated to at least 34,000–35,000 BP (15, 17). Clearly, there is no reason whatever to regard this as a diagnostically later as opposed to early Aurignacian artifact, and no reason to invoke this find to question the dating of the immediately overlying later Chatelperronian levels to between 34,500 BP and 36,000 BP, as unambiguously indicated by the seven radiocarbon dates for these levels. To hang such crucial chronological arguments on these two isolated and enigmatic finds seems to us totally unjustified. Needless to say we are not suggesting (contrary to the comment by Zilhão *et al.*) that Chatelperronian technologies continued to be manufactured in this region until ≈20,000 BP.

We come, finally, to the distribution of other typically Aurignacian pieces within the Châtelperron sequence. Here we are pleased to see that Zilhão *et al.* accept that there were at least 11 fully “diagnostic” Aurignacian artefacts recovered during Delporte’s excavations, and that at least five or six of these pieces were indeed “concentrated” in levels B4 and B4a (see figure 2 of ref. 10). To this we would add the two perforated animal tooth pendants (a fox canine and a red deer canine) also recovered by Delporte from this level (ref. 1, figure 3). Although Zilhão *et al.* (predictably) suggest that the latter could conceivably be Chatelperronian specimens (by analogy with the finds from the Grotte du Renne at Arcy-sur-Cure), one of the teeth in question has already been described by Randall White (ref. 18, p. S31) as showing techniques of perforation “consistent with that of the hundreds of Aurignacian pierced teeth I have examined, and in contrast with the hole perforation techniques I have observed [on specimens of Chatelperronian pierced teeth] at Arcy and Quinçay.” We note that not a single additional specimen of a perforated tooth was recovered from any of the other levels at Châtelperron, from either the basal (B5) or overlying (B1–B3) Chatelperronian levels. All of this fully bears out Delporte’s repeated assertions that the diagnostically Aurignacian pieces, manufactured exclusively from a range of distinctive, high quality imported flints (1, 5, 6, 10), were indeed concentrated strongly if not entirely in level B4 of his stratigraphy [a level which he argued also

showed a clear increase in the length/breadth ratios of the blade component of the assemblages (6)], an interpretation that he firmly maintained throughout his career (ref. 7, p. 33).

Whether any diagnostically Aurignacian pieces were found in any other levels of the Chatelperronian sequence appears to us open to serious doubt. We are frankly unconvinced by the tiny (≈ 2 cm) fragment of a supposedly “end scraper on Aurignacian blade” recovered from level B2 and illustrated in figure 2*f* of ref. 10, and the other two pieces illustrated (from level B5 and combined levels B1–B3) could very easily derive from the immediately adjacent level B4, as Delporte himself (ref. 6, p. 56) emphasized. The presence of two closely similar and highly typical Dufour bladelet forms (ref. 10, figure 2*g* and *h*) recovered by Delporte from the topsoil horizon (his layer A) are particularly interesting, because they could well indicate a further, brief episode of occupation by later Aurignacian groups sometime after the accumulation of the full sequence of underlying Chatelperronian levels, a situation reminiscent of that recorded at the Grotte du Renne at Arcy-sur-Cure, some 130 km to the north (19). Interestingly, the occurrence of these two almost identical pieces in the topsoil horizon provides yet a further argument against the hypothesis that the whole of the upper part of Delporte’s sequence represents a recent backdirt formation. Why should these two typologically almost identical specimens occur in precisely the same level at the top of a sequence of totally unstructured and unstratified 19th century backdirt deposits? One might equally ask why the 76 faunal remains recovered by Delporte from the same level showed a very much higher frequency of human modification (burning, cut marks, etc.) than those from any of the underlying levels (i.e., 9% of the bones from level A, as compared with only 2% of the bones from the underlying levels B1–B5: ref. 10, table 2), unless of course Zilhão *et al.* are suggesting that these are modern, 20th century specimens. We would suggest that these are most probably the traces of later Upper Palaeolithic, or even historic, activity on the site. Finally, we would ask why none of the upper, supposedly backdirt levels (B1–B3) yielded any trace of typically Mousterian artefacts (as Delporte repeatedly stressed: ref. 5, p. 63, and ref. 7, p. 18), because we know that the basal Mousterian levels were extensively excavated during the 19th century work on the site (6, 20). It might also be noted that the only instance of refitting within the Châtelperron sequence was recorded by Delporte himself (ref. 6, p. 35) for two fragments of a Châtelperron point recovered respectively from level B3 and the topsoil horizon (layer A), confirming his conclusion that the topsoil horizon did contain some genuine backdirt from the 19th century excavations. Significantly, Zilhão *et al.* (10) found no examples of refits between the material from levels B4–B5 and their inferred backdirt in levels B1–B3.

The Credentials of Delporte’s Stratigraphy

Perhaps the most extraordinary (if perhaps unintended) aspect of the Zilhão *et al.* backdirt hypothesis is the remarkable degree of archaeological incompetence it implies in the conduct and recording of Delporte’s excavations at Châtelperron. In all of his published reports he consistently described a clear and sharply defined sequence of five principal Chatelperronian levels, extending through a total depth of between 1.0 and 1.5 m of deposits, in the following terms:

Between 1.1 and 1.5 metres in thickness, this layer contains a number of thin, subhorizontal levels, coloured red, more or less clear and continuous, in which, or in contact with which, are found the great majority of the remains of human occupation. Five levels can be distinguished, of which the density and importance increase from top to bottom, and with which are associated localized traces of secondary levels. The last principal level (B5) is more important than the others,

the red colouring attaining a thickness of 4–5 cm (ref. 6, p. 11).

In his successive reports, extending from his initial account of the 1952 excavations (2) to his final summary of the site published as recently as 1999 (7), Delporte repeatedly stressed (and illustrated) five major features of this sequence (2–7):

1. Each of the five principal Châtelperronian horizons (levels B1–B5) was marked by a thin level of strongly reddened sediments, the thickness of which increased progressively from the upper to the lower levels;
2. The deposits that separated these reddened horizons were marked by much paler, buff-colored sediments;
3. The distribution of “occupation material” was concentrated “almost exclusively” within these reddened levels, with little if any material in the intervening deposits;
4. The five major reddened horizons were found to be essentially parallel and “subhorizontal” throughout all of the areas of the excavations, and are shown in the two major stratigraphic sections published by Delporte (see SI Figs. 4 and 5) as extending in this pattern over a total distance of at least 6 m from east to west; and
5. A level of flattened stones was found at the top of level B3, separating levels B3 and B2.

Evidently, this clear and sharply defined stratigraphic sequence is totally inconsistent with any version of the 19th century backdirt hypothesis. Even if we accept that backdirt deposits could occasionally include short segments of “pseudostratigraphy” (reflecting, for example, individual spadefuls of material deriving from different sedimentary contexts) there is clearly no way in which these could be traced in such a regular, consistent, “subhorizontal” way over a distance of over 6 m. Even allowing for the fact that this was Delporte’s first major excavation on a Palaeolithic site, it is inconceivable that Delporte could have “imagined” this clear-cut stratigraphic pattern within a succession of totally unstructured 19th century backdirt deposits. In this context it should be recalled that immediately after his excavations at Châtelperron, Delporte went on (in 1955) to conduct a major excavation at the site of Abri du Facteur in the Perigord region, which was described by the late Hallam L. Movius (based on his close personal contacts with Delporte’s excavations) as “des fouilles soigneuses et méthodiques,” subsequently published as “une monographie minutieuse et exhaustive” (ref. 21, p. 308). This does not read like the description of an incompetent or unreliable excavator.

The backdirt hypothesis would of course imply that Delporte was not only unable to recognize sharply defined stratigraphic patterns in his excavations, but also equally incapable of recognizing the inevitable contrasts between the character of recent, unstratified backdirt deposits and fully *in situ* occupation deposits formed on the site >35,000 years ago. Needless to say, Delporte was acutely conscious of this question at the time of his excavations and went to great pains to identify and plot the exact spatial extent of the 19th century excavations on his two published site plans (see Fig. 2). As discussed above, the photograph of his box section excavation (Fig. 1) strongly bears out his accurate definition of the limits of the 19th century excavations in this part of the site. To impute such levels of incompetence to someone with Delporte’s record of subsequent meticulous excavations at a range of similar cave and rock-shelter sites in France (Le Facteur, La Ferrassie, La Rochette, and Brassempuy) is even more remarkable.

Conclusions: Theoretical Agendas and Archaeological Facts

We conclude that the foregoing analysis decisively refutes the 19th century backdirt hypothesis for either the whole or part of the long Chatelperronian sequence described by Delporte at Châtelperron, and that it fully corroborates his conclusion that there was a clear concentration of diagnostically Aurignacian artefacts within or

immediately adjacent to level B4 of his stratigraphy, clearly stratified between the typically Chatelperronian material in his level B5 and the equally typical Chatelperronian material in the overlying levels B1–B3. We have never disputed (contrary to the claims of Zilhão *et al.*) that the level excavated by Delporte as B4 contained a mixture of both Chatelperronian and Aurignacian artefacts, and we pointed out in our original paper (ref. 1, p. 464) that this thin (and stratigraphically indistinguishable) horizon of Aurignacian material was almost certainly incorporated during the major depositional hiatus spanned by the two radiocarbon dates secured on bone samples from level B4 (Fig. 3). We never suggested that this ephemeral Aurignacian occupation spanned the entire period from $\approx 39,000$ BP to 36,500 BP, and on present evidence this occupation could easily date from as late as, say, 36,000–37,000 BP, closely comparable to dates secured for similar early Aurignacian industries from a number of sites (e.g., das Geissenklösterle, Keilberg-Kirche, and Willendorf) in the adjacent areas of Central Europe (17, 22–24). But this would still rank as the earliest occurrence of “classic” (as opposed “proto”) Aurignacian technology so far recorded in France (15, 17).

We fully understand of course that what lies behind the critique by Zilhão, d’Errico, *et al.* of the Châtelperron stratigraphy is a long-standing agenda to deny the possibility of significant chronological overlap and coexistence between late Neanderthal and early anatomically modern populations in western Europe, and therefore to deny any suggestion of potential mutual interaction or “acculturation” between the two populations (13, 14, 25), as the introduction and conclusions of their recent PNAS paper (10) make clear. But surely the inconsistency of this stance is now self-evident. If we accept that there was indeed a major dispersal of anatomically and genetically modern populations across Europe, as almost all palaeoanthropologists and geneticists now accept (26–29), then some degree of chronological overlap and coexistence between the final Neanderthals and the earliest incoming populations of biologically and behaviorally modern humans is totally inescapable, unless of course we suggest that the native Neanderthal populations effectively self-destructed the moment the first modern populations set foot in their territories. This scenario is not merely plausible in terms of our understanding of the totality of the current palaeo-anthropological and genetic data, but effectively inevitable and predictable in theoretical and demographic terms (26–33).

This is not to suggest that we accept the evidence from all of the other sites where interstratifications between Chatelperronian and Aurignacian occupations have been claimed, and we respect the evidence advanced by J. P. Rigaud (8), J. G. Bordes (9), and others to reject the evidence originally reported for such an interstratification at the Roc-de-Combe in southwest France, and probably also that from Le Plage. But to extrapolate blindly from the evidence of one site to that of another is clearly procedurally and scientifically untenable. In the case of Châtelperron, there are several other crucial factors to be kept in mind. Châtelperron is not located in the “classic” region of southwestern France but much further to the north and east, and accordingly much closer to southern Germany and other parts of west-central Europe, from which the original influx of Aurignacian populations into France almost certainly derived (17, 22, 23, 33). As noted above, there is now effectively conclusive evidence from several sites in Central Europe that early Aurignacian populations were present from at least 37,000–38,000 BP onward, as reflected at the radiocarbon-dated sites of das Geissenklösterle and Keilberg-Kirche in southern Germany and Willendorf in Austria (17, 22–24), despite all of the repeated protests of Zilhão and d’Errico (refs. 13, 14, etc.) to the contrary. Clearly, this east-central region of France is precisely the area in which one would expect the earliest incursion of anatomically modern populations to have occurred and which is therefore, *a priori*, most likely to show evidence for a broad coexistence and contemporaneity of Chatelperronian and Aurignacian populations at any time from $\approx 37,000$ –38,000 BP onward. In our earlier paper (1) we argued that the Châtelperron sequence could well reflect a number of successive territorial displacements between Chatelperronian and adjacent Aurignacian populations within this region, in close response to contemporaneous climatic and environmental fluctuations during the later stages of oxygen-isotope stage 3. This, in short, is precisely what the evidence from Châtelperron suggests, in our view a totally unsurprising, as well as archaeologically strongly documented, occurrence.

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