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Lithic taphonomic refitting and post-depositional artefact movement at Mesolithic artefact scatters in Belgium

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"Where was the original Mesolithic [...] occupation horizon? Is it still preserved?"
(Vermeersch, 2006: 298)

1. Introduction

The Mesolithic record on Belgian territory is generally perceived of as one characterized by a poor resolution in terms of stratigraphic and organic preservation. According to our current knowledge and with some notable exceptions, this applies to both open-air and cave contexts in dry and wetland areas and for remains found at or buried (deeply) below the present-day surface. This (sub-)surface Mesolithic record results from a complex array of depositional and post-depositional formation processes. Spatially well-defined clusters of stone artefacts, usually within non-stratified sedimentary contexts, are an important part of this record. If present, preserved and excavated properly, lithic clusters can be found in spatial association with charred and/or burnt organic remains and with soil features of anthropogenic and/or biogenic origin, the interpretation of which remains challenging. Other important recurrent characteristics of Mesolithic artefact clusters in Belgian soils include a general absence of evident anthropogenic structural features and an important vertical dispersion of the objects within the natural deposits, and therefore a lack of 'living floors' or 'occupation horizons'. This vertical distribution of artefacts at excavated Mesolithic sites varies from a few decimetres up to more than a metre.

Radiocarbon dating using strict protocols indicates the omnipresence of complex 'aggregates' (*sensu* Rezek *et al.*, 2020) or 'palimpsests' at different scales (*sensu* Bailey, 2007), implying major conceptual and inferential issues with preservation, homogeneity, contemporaneity, and integrity of the clusters. This not only applies to larger and/or more dense clusters (as is generally accepted) but equally to the smaller and/or less dense ones or non-clustered part of the lithic record (as is too often neglected). The negative emphasis implied by the palimpsest label, resulting in an unfortunate preference for sites with presumably short-term events or occupations (Rezek *et al.*, 2020), is applicable to Belgian Mesolithic research. But given the omnipresence of palimpsests, and in contrast with the view that there is an ideal type of deposit on which inferences should be built, one should step away from the negative connotation of the term and the inherent idea that palimpsests need to be disentangled to be of any inferential value.

In the same paper, Rezek *et al.* (2020) argued that archaeologists should follow rigorous procedures along their inferential path from the archaeological record to past behaviours, by separating between "what we see archaeologically -the artifacts in their present sedimentary context- and inferences from these artifacts". The nature and meaning of the observed vertical artefact dispersion at Mesolithic sites in Belgian soils received considerable attention from the 1970s onwards (e. g. Vermeersch, 1975, 1976, 1977, 1982, 1989, 1996, 1999, 2006, 2013; Van Noten, 1978; Van Noten *et al.*, 1980; Lauwers & Vermeersch, 1982; Gendel *et al.*, 1985; Gob & Jacques, 1985; Lausberg-Miny *et al.*, 1985; Vynckier & Vermeersch, 1985a; Vermeersch *et al.*, 1992; Vermeersch & Bubel, 1997; van der Sloot, 1999; Pilati, 2001; Bubel, 2003; van der Sloot *et al.*, 2003; Noens & Crombé, 2012; Crombé *et al.*, 2019; etc.). In order to explain these particular distribution patterns these studies took various pathways, including (a combination of) pedological analyses of soil profiles, lithic refitting, contemporary experimentation, descriptions and analyses of the vertical distribution patterns of the artefacts (focussing on topics such as size-sorting effects, differential distributions according to raw materials, and the search for occupation surfaces and latent or 'phantom' stratigraphies), as well as unsubstantiated assumptions or simple references to studies from other areas and/or time-periods. Vertical artefact dispersion at excavated Mesolithic sites in Belgium has traditionally been interpreted in terms of post-depositional, up- and/or downward migration of objects through a diversity of human and/or natural agents (e. g. trampling, root growth, tree windthrows, burrowing animals, freeze/thaw, etc.). Whereas many different processes may be responsible for artefact movement within soil deposits, with a cumulative effect resulting in complex patterns that are difficult to entangle (e. g. Wood & Johnson, 1978; Villa & Courtin, 1983; Barton, 1987, 1992; Schiffer, 1987), soil-mixing by small burrowing fauna following artefact deposition is generally assumed to be the principal mechanism for these inferred artefact displacements at Belgian Mesolithic sites (e. g. Vermeersch & Bubel, 1997; Vermeersch, 1999; Crombé *et al.*, 2019). This interpretation of post-depositional artefact displacement as a result of faunalturbation is no longer being challenged in contemporary intrasite studies and generally put forward, often without any further inquiry, as the principal explanation for the observed patterns at lithic artefact clusters associated with non-stratified deposits.

Other forms of post-depositional (sub-)surface artefact movement inferred for the Belgian Mesolithic record include vertical and/or lateral displacement due to tree windthrows, natural slope erosion or through modern agricultural practises, amongst several other processes (e. g. Crombé, 1993, 1998a, 1998b; Vermeersch, 1994, 2006; Vermeersch & Bubel, 1997; De Bie *et al.*, 2014; Crombé *et al.*, 2019; etc.). By tradition, agriculture is an important activity in many parts of Belgium. Given that most Mesolithic remains in this area are to be found at or just below the present-day surface, agricultural activities such as ploughing are seen as major disturbing factors of the Mesolithic record, resulting in artefact clusters that are partly or completely displaced and incorporated into homogenized plough layers. The negative impact of ploughing on the integrity of the Mesolithic record in the Low Countries has frequently been addressed (e. g. Groenewoudt, 1994; Vermeersch, 1994; Crombé, 1998a, 1998b; Deeben, 1999; Verhart, 2006; Smit, 2010; De Bie *et al.*, 2014). Given that major parts of the Mesolithic record in this area are associated with such recently disturbed contexts, and in order to avoid a biased view on the prehistoric past, issues of (scientific) value, information potential and the question of how to adequately deal with this highly vulnerable, disturbed part of the prehistoric record remain important, legitimate, and pressing questions. While there is a growing tendency to simply ignore this extensive part of the record, in line with a prevailing preference for assumingly well-preserved buried sites reflecting short-term events or occupations, one always needs to assess the relationship between the surface and subsurface components of these artefact distributions on a site by site basis, as was previously noted by several prehistorians (i. e. Deeben, 1999; Smit, 2010; De Bie *et al.*, 2014; Perdaen *et al.*, 2016).

An accurate reconstruction of the complex formation history of the Mesolithic record demands for an interdisciplinary perspective. Refitting of knapped lithics has an important role to fulfil in intrasite studies (e. g. Noens & Van Baelen, 2016). From its initial appearance in the archaeological literature during the second part of the 19th century, but particularly during the past 50 years, refitting has been viewed as a powerful, albeit time-consuming, tool in the unravelling of formation processes of the lithic record, even more so when applied systematically and combined with other analytical tools in an interdisciplinary perspective. It basically relies on an artificial physical reconnection of (parts of) complementary fracture surfaces of at least two lithic objects which until one point in the past where one and the same object or belonged to the same, larger volume of rock. That point in the past is the moment when the fracture process took place and each resulting smaller rock fragment subsequently started its existence as a separate entity (possibly to be fractured at a later point into even smaller fragments), constituting the beginning of their individual life-history trajectories from initial creation to final deposition. This implies that the fragmented pieces (either as stand-alone objects or as part of larger rock fragments) were together at the same place during the moment of fracture, a place which is unknown -and unknowable- to the archaeologist and which may or may not be the same as those of the later fragments. Stresses leading a rock to fracture can occur at any time prior, during or subsequent to its deposition and can have many different causes, both naturally or humanly induced with the latter being created on purpose or by accident. Causes of rock fracture thus not only include artefact manufacture, use or maintenance, but also a range of other mechanical or thermal processes that occur during or after manufacture, use, maintenance, or final discard of the artefacts. By physically linking objects in time (at least relative to one another) and in space (if their provenance is recorded with sufficient detail during recovery), lithic refitting can thus become a powerful tool to provide valuable information on such topics as post-depositional artefact movement, internal site chronology, lithic technology and spatial patterning of past human behaviour. As a scientific tool, it can be viewed as an 'aggregate' approach, i. e. focussing on groups of artefacts instead of individual artefacts (Steffen *et al.*, 1998; Andrefsky, 2001; Bleed, 2004; Larson, 2004), which includes more -and is more complex- than the mere physical reconnection of the lithic artefacts. As such, it does not only involve the process of putting fragments together again, but also encompasses the painstaking process of analysing the resulting refitted (and non-refitted!) datasets, an aspect that too often remains underexposed in the ultimate publication of refitting results, at least with regard to the Belgian Mesolithic.

It has been argued repeatedly that in-depth intrasite analyses including systematic refitting are still in their infancy for the Belgian Mesolithic (e. g. Vermeersch, 1984, 1989, 1999; Crombé, 1990, 1996a, 1996b, 1998a, 1998b; Crombé & Cauwe, 2001; De Bie, 2004; Van Gils *et al.*, 2010; Noens & Crombé, 2012; Noens, 2013), notwithstanding some important recent contributions. To our knowledge, a brief report by Janssens (1958) on the site of Oostmalle – Bruulbergen is the first on lithic refitting for the Belgian Mesolithic. It was published more than seven decades after Mesolithic artefacts -then labelled as *des petits silex*- were first discovered in Belgian soils (e. g. De Puydt, 1885; De Puydt & Lohest, 1886; de Pierpont, 1893; Gilles de Pélichy, 1893; etc.), well before the term 'Mesolithic' was in use for this area, and during the same period when refitting was first reported for Belgian archaeological collections, e. g. for the Neolithic site of Spiennes by Cels & De Pauw (1886) and for the Palaeolithic site of Saint-Symphorien - Carrière Hélin by de Munck (1893a, 1893b).

Since Janssens' first refit attempts over sixty years ago, but particularly from the mid-1970s onwards, over a hundredth publications presented refitting results from Belgian sites dating back to the Final Pleistocene and Early Holocene periods, including the so-called '(Epi-)Ahrensburgian' and Mesolithic. These accounts relate to over 50 sites corresponding to over 90 individual artefact clusters (Fig. 1). Refitting at multi-cluster sites (i. e. 'intercluster', 'interlocus' or 'intersite' refitting) has by no means been limited to the confines of individual clusters, contra Sergant *et al.* (2018: 621-622) who recently pointed to a total lack of intercluster refitting for the Early and Middle Mesolithic in the northern part of Belgium. According to our dataset, refitting between Mesolithic clusters from the same site has actually been attempted, either brief or more extensively, for no less than 20 sites, including clusters attributed to the earlier, middle and later phases of the Mesolithic of the northern part of Belgium. Yet, for one reason or another, not all of these refit attempts actually resulted in physical links between the clusters. This

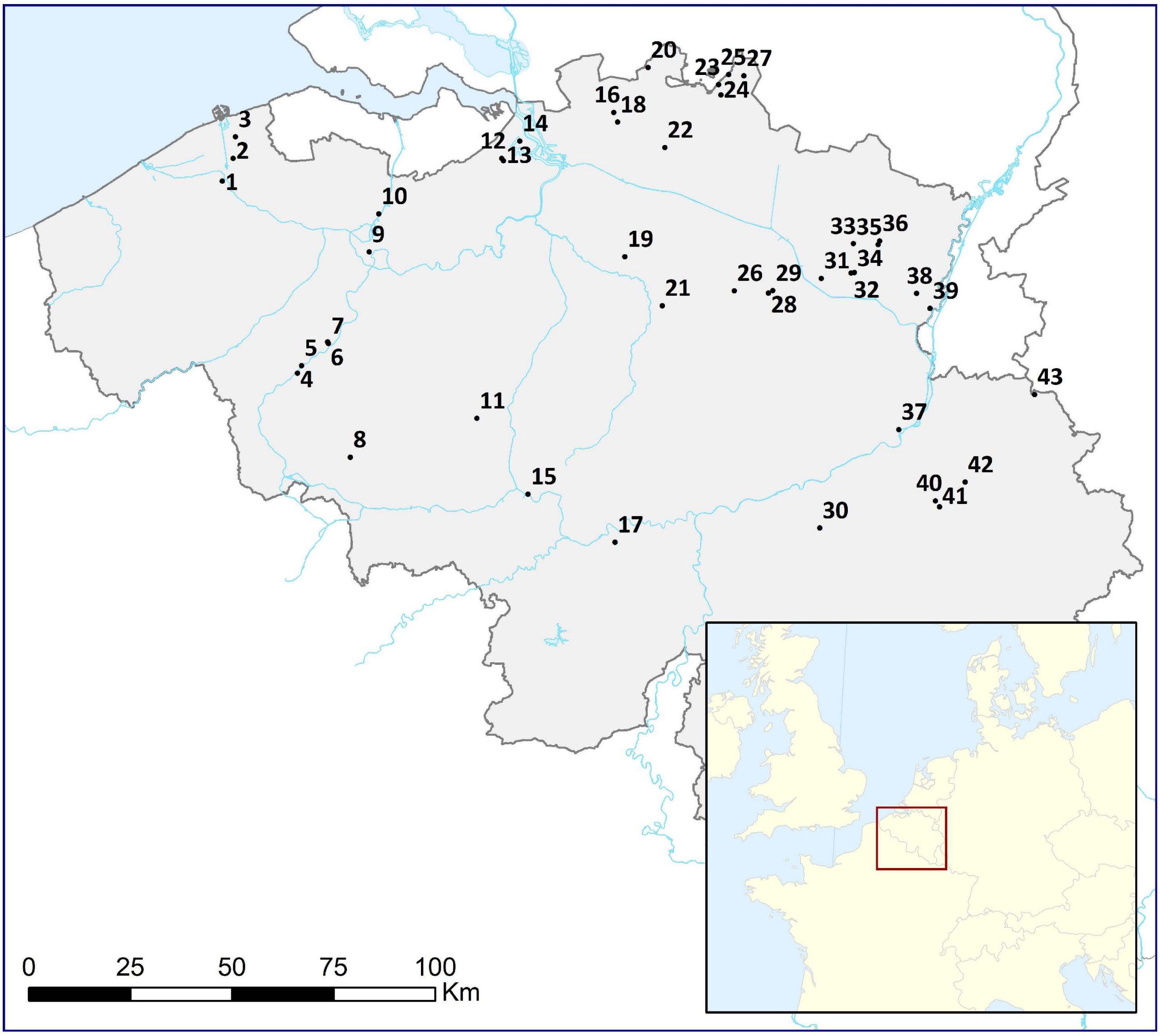

Fig. 1 – Final-Pleistocene and early Holocene archaeological sites where lithic refitting took place.
1. Sint-Michiels – Barrièrestraat; 2. Koolkerke – Arendstraat; 3. Dudzele – Zonnebloemweg; 4. Ruien – Rosalinde; 5. Kerkhove – Stuw; 6. Oudenaarde – Donk Meso 1; 7. Oudenaarde – Donk 2003; 8. Blicquy – Ville d'Anderlecht; 9. Gent – Tweekerkenstraat; 10. Evergem – Nest; 11. Rebecq – Le Spinoi; 12. Verrebroek – Ambachtelijke Zone; 13. Verrebroek – Logistiek Park Waasland Fase West; 14. Doel – Deurganckdok Sector J/L; 15. Thieusies – Ferme de l'Hosté; 16. Brecht – Overbroek; 17. Presles – Trou de l'Ossuaire; 18. Brecht – Moordenaarsven 2; 19. Putte – Koolhof; 20. Meer – Meirberg; 21. Holsbeek – Rotselaarsebaan 2; 22. Oostmalle; 23. Weelde – Eindegoorheide; 24. Weelde – Paardsdrank; 25. Weelde – Bedafse Heide; 26. Assent – Luienberg; 27. Weelde – Voorheide; 28. Donk – Krikeldries; 29. Schulen; 30. Petit-Modave – Trou al'Wesse; 31. Zonhoven – Bolderdal; 32. Zonhoven – Kapelberg; 33. Helchteren – Sonnisse Heide; 34. Zonhoven – Molenheide; 35. Meeuwen – Monnikswijer; 36. Meeuwen – In Den Damp; 37. Liège – Place Saint-Lambert; 38. Opgrimbie – De Zijp; 39. Neerharen – De Kip; 40. Sougné A – Walter Fostier; 41. Remouchamps – Station Leduc; 42. Theux – L'Ourlaine; 43. Kelmis – Brenn Hag.

Mesolithic refit-dataset from Belgium on which we draw contains nearly 10.000 refitted artefacts that are part of around 1.800 different refit-sets. However, these numbers are to be considered as underestimations given that for two-thirds of the dataset no accurate information is available on either the number of refitted artefacts, the number of refit-sets, the number of artefacts per refit-set and/or the total number of recovered artefacts. While the intensity of refitting remains largely unclear from an inspection of the original sources, at least one-fifth of these refit-studies was said to be extensive or systematic, although in these cases, too, further details on the amount of time and effort invested in the process generally remains obscure. In addition to extensive and systematic attempts, refitting was seen in some instances as a cursory and anecdotal activity or as a preliminary attempt to test its potential for the collection at hand or to address specific questions. Despite frequent multidisciplinary studies with refitting, including attribute, microwear, spatial and/or chronometric analyses, few indications exist for a true interdisciplinary perspective, i. e. an integration of refitting results with the other types of (lithic) analyses.

Regardless of its intensity and whether or not it was part of interdisciplinary approaches, lithic refitting of Belgian Mesolithic collections has contributed to any of the above-mentioned research topics. This paper will specifically focus on the topic of post-depositional artefact movement at and below the present-day surface and how it was studied for the Belgian Mesolithic by means of lithic refitting. According to our dataset this topic was addressed for at least 18 of the 50 refitted collections. This paper will provide an overview of these 'taphonomic' refit-studies (*sensu* Larson & Ingbar, 1992) by addressing their arguments and lines of reasoning as part of the inferential process to arrive from an observed pattern of vertical and lateral artefact dispersion to an inferred artefact displacement.

2. Refitting and vertical displacement

Since the late 1970's refitting has contributed in several ways to the hypothesis of vertical migration of lithics due to post-depositional bioturbation processes at Belgian Mesolithic artefact clusters (e. g. Van Noten, 1978; Van Noten *et al.*, 1980; Lauwers & Vermeersch, 1982; Gendel *et al.*, 1985; Gob & Jacques, 1985; Lausberg-Miny, *et al.* 1985; Vynckier & Vermeersch, 1985a; Vermeersch *et al.*, 1992; van der Sloot, 1999; Pilati, 2001; van der Sloot *et al.*, 2003; Noens & Crombé, 2012; Vermeersch, 2013). The pioneer 'palethnographic' approach at Meer – Meirberg II (initially attributed to a Holocene variant of the Tjongerian, but with an unmistakable Mesolithic component) was the first to apply lithic refitting to the question of post-depositional vertical artefact movement in the context of the Belgian Mesolithic. Without providing supporting data, but presumably referring to Cahen's refit-work, and under the (questionable) assumption that refitted artefacts are contemporaneous, Moeyersons (in Van Noten, 1978: 27-28) relied on the connection of artefacts found above and below an impenetrable B-horizon of a podzol soil to argue for an anteriority of artefact displacement relative to the formation of this soil. Building upon contemporary observations at some African sites (e. g. Cahen & Moeyersons, 1977; Moeyersons, 1978, 1980), Moeyersons' study at Meer II is the only reported case for the Belgian Early Holocene to use lithic refitting in an attempt to provide a relative age estimation for soil formation processes. While he considered vertical artefact displacement at this site to be a poorly understood process, Cahen in the same site-monograph (Van Noten, 1978: 61-63) firmly refuted the hypothesis of multiple site re-use in favour of one of biogenetic post-sedimentary perturbations as the most viable explanation for the observed vertical dispersion of the lithics. This view was repeated several years later when reassessing some of his earlier interpretations (Cahen, 1984: 241). His arguments in favour of a post-depositional artefact displacement, instead of successive occupations, not only include a physical connection of artefacts from different depths, but also the fact that the vertical distribution of refitted artefacts does not respect the chronological order of artefact removal. Both aspects, which are repeated in several subsequent Mesolithic refit-studies (infra), were visualised by means of a graph (Van Noten, 1978: fig. 13). The initial version of this diagram shows 24 refit-lines from six refit-sets, including both ventral-dorsal and break connections. The question of whether the vertically distributed artefacts at Meer II reflect successive occupations or a single one dispersed vertically by natural processes was re-addressed by Van Noten *et al.* (1980: 50-52), using an up-dated version of the original diagram and a slightly different dataset (Van Noten *et al.*, 1980: 47). Based on this smaller dataset, Van Noten *et al.* firmly stated that a "single occupation at Meer II was demonstrated by the refitting studies. [...] Evidently the old soils had been churned by natural forces such as root growth, which separated the related artefacts". The possibility of a co-occurrence of both hypotheses (i. e. multiple occupations and post-depositional displacement) was not considered.

Following these early insights from Meer II, subsequent refit-studies at other Belgian Mesolithic sites used more or less similar reasoning to argue for post-depositional vertical artefact movement, albeit not necessarily combined with an (explicit) hypothesis of a single occupation put forward by Cahen for Meer II. These refit-studies relate to the sites of Neerharen – De Kip (Lauwers & Vermeersch, 1982); Helchteren – Sonnisse Heide 2 (Gendel *et al.*, 1985), Donk – Krikeldries (Vynckier & Vermeersch, 1985a, 1985b), Brecht – Moordenaarsven 2 (Vermeersch *et al.*, 1992), Liège - Place Saint-Lambert secteur S.D.T. (van der Sloot, 1999; van der Sloot *et al.*, 2003), Doel – Deurganckdok sector J/L (Noens & Crombé, 2012), and Zonhoven – Molenheide (Vermeersch, 2013).

For Neerharen – De Kip, Lauwers & Vermeersch (1982: 23) not only stressed a tight vertical clustering of many excavated artefacts -despite an important maximum vertical distribution when including all artefacts (i. e. at least ca. 50-60 cm) - but also observed that 33 artefacts from a single refit-set were widely dispersed vertically (at least 45 cm) without following any chronological order. As was the case for Meer II, this pattern was presented in the form of a graph on which ventral-dorsal refits were distinguished from break refits (Lauwers & Vermeersch, 1982: fig. 4). Curiously, break refit-lines in their graph – including two adjoining ones linking three fragments of the same artefact- are also represented as a chronological succession. Although Lauwers & Vermeersch did not explicitly link their observation from this extensive refit-set with any particular interpretation, they did refer to "similar observations" from Meer II (Lauwers & Vermeersch, 1982: 23), and elsewhere in the same site-monograph invoked bioturbation as an explanation for the observed vertical distribution of the remains, thought to be a reflection of a single Early Mesolithic occupation of short duration based on the *simple structure* of the site and the limited number of tools (Lauwers & Vermeersch, 1982: 21, 23, 52).

More or less similar observations were made by Vynckier & Vermeersch (1985a: 54) for the ploughed site of Donk – Krikeldries, equally attributed to the Early Mesolithic but with several residual and intrusive lithic elements. Around 70 % of the excavated artefacts from this site were recovered from a vertical band of 25 cm wide, with a maximum dispersion of 65 cm. This vertical dispersion, too, was linked to bioturbation (e. g. root activity, burrowing fauna). The few refit-sets -none of which, however, were discussed in any detail- were said to cover vertical distances of up to 25 cm, but as was the case for Neerharen no further interpretation was attached to this observation.

More or less in line with the diagrams from Meer and Neerharen, Gendel *et al.* (1985: 7 + fig. 3) relied on two larger refit-(sub ?)sets from Helchteren – Sonnisse Heide 2, including 20 and 23 artefacts, to conclude that "[r]efits span a thickness of about 40 cm, nearly that of the entire archaeological stratum". Both refit-sets depicted on their graph include a core, on the graph curiously placed in the middle of each sequence (it therefore remains enigmatic whether or not the refit-lines on this graphs reflect the removal chronology of the artefacts) and no information is provided on the type of refit-line. Both refit-sets were used in combination with the weight distribution of flint artefacts recovered from the same squares to argue not only for the presence of an "original occupation surface" somewhere at a 15 cm interval but also for size-sorting effects, resulting in a "greater vertical displacement of lighter artifacts upwards and downwards" from this presumed occupation surface. The vertical distribution of artefacts at this site exceeded 50 cm (Gijselings, 1983: 95-96) with ca. 75 % of the lithics dispersed in a vertical band of 25 cm wide and over 90 % in a band of 35 cm, within the B2-horizont and the lower portion of the A2-horizon of a podzol soil (Gendel *et al.*, 1985: 5). Two peaks were observed in this vertical distribution pattern, the lower one tentatively attributed to root growth, given that: "tree roots tend not to penetrate the compact iron horizon. Rather, they spread laterally at this level, displacing artifacts upwards and downwards" (Gendel *et al.*, 1985: 5). The site was interpreted by Gendel *et al.* as the remains of "a brief occupation characterized by a special set of activities", including "a brief episode of flint knapping, undertaken around a single hearth" and the "manufacture and retooling of hunting equipment".

Vermeersch *et al.* (1992: 67) relied on 37 artefacts from six refit-sets from Brecht – Moordenaarsven 2 to argue that "artifacts can move, probably because of postdepositional bioturbation processes, over depths of at least 0.25 m". These six refit-sets included between 3 and 11 artefacts with a maximum vertical dispersion of 30 cm between the artefacts from a refit-set. As was the case for Meer, Neerharen and Helchteren, the refit-patterns were visualised using a graph, without, however, distinguishing between different types of refit-lines (Vermeersch *et al.*, 1992: fig. 21). Information on artefact dispersal at this site varies somewhat according to the author. Following the site monograph by Vermeersch *et al.*, most artefacts of this partly disturbed site were recovered from the lower part of an A2- and the upper part of a B-horizon of a humic-iron podzol, with a total vertical dispersion exceeding 35 cm. The majority of artefacts was, however, found in a band of 15 cm, based on extrapolations from a 16 by 1 metre transect across the site including only 9 % of all recovered artefacts (Vermeersch *et al.*, 1992: 38). Whereas Lauwers & Gendel (1982) initially noted a 15 cm wide band for 95 % of the artefacts and Bosschaerts (1984) a 10 cm band for 75 % of the artefacts and a 15 cm band for 97 % of the artefacts, Gendel & Lauwers (1985) observed that ca. 90 % of the artefacts were found in an interval of 15 cm at a depth of 30-45 cm, with a unimodal distribution. The latter further observed that "refits link the upper and lowermost portions of the archaeological stratum" without, however, providing further details. The Gauss distribution curves recorded for most of the excavation squares from the trench described by Vermeersch *et al.* (1992) were interpreted in terms of a "displacement of the remains both upwards and downwards" without any evidence of a superposition of multiple distinct artefact horizons. A further interpretation of these patterns in terms of the original occupation floor(s) or site re-use was left open to discussion with several hypotheses put forward: "The vertical artifact distribution at BM2 fits probably best with a single artifact horizon. It is, however, not clear if the single artifact horizon also corresponds with a single occupation. In order to be sure about that problem, one should understand the postdepositional processes which affected the occupation horizon(s). Unfortunately, one cannot. The main unsolved problem is the question of the original position of the artifacts. Have they been covered, posterior to the occupation as is assumed by F. Gullentops [in this site monograph], by 15 to 20 cm of aeolian sands, and/or is the subsequent vertical distribution a result from trampling during occupation and bioturbation after man vacated the site? Or, did all artifacts migrate downwards from the present IIA1-horizon surface due to bioturbation? [...] For now, we can only state that the profile does not provide arguments for more than one occupation horizon. It can, however, not been excluded that more than one occupation took place. [...] If bioturbation is responsible for the vertical artifact distribution, it occurred before the formation of the humic-iron podzol" (Vermeersch *et al.*, 1992: 41). Despite these unresolved issues, Vermeersch *et al.* relied on radiocarbon evidence, microlith composition, typology and raw materials to tentatively put forward a hypothesis of (at least) two diachronic Mesolithic occupations, and the collection was subsequently subdivided into "two separate hypothetical assemblages which will be considered as homogeneous" (Vermeersch *et al.*, 1992: 57), further adding that "[t]he vertical distribution of the two Mesolithic occupations attests a very similar, or even identical, pedostratigraphical position from which it can be concluded that both assemblages have an identical post-depositional history. [...] The present pedostratigraphical position of the artifacts, some 25 cm below the soil surface, probably resulted from bioturbations which occurred in the Atlantic soil but rather late during the Atlantic or even during the Subboreal, posterior to the deposition of the late BM-2 archaeological material around 6200 BP" (Vermeersch *et al.*, 1992: 66). The scenarios put forward by Vermeersch *et al.* for this site were further tested by Bubel (2003: 405- 438). Through analysis of artefact size, orientation and typology relative to artefact depth in a 15 %-sample of all recovered artefacts (but hardly taking into account the smaller pieces recovered in the sieve for which no point-provenience data were recorded, and thus severely biasing her study), and referring to palyno-, pedo- and geomorphological observations and the vertical distribution pattern of the artefacts as supporting evidence, she identified a size-sorting pattern but no obvious relations between typology or orientation versus depth. Based on her observations, Bubel not only supported the hypothesis of two diachronic Mesolithic occupations, adding that "both would have taken place at the same surface level" (Bubel, 2003: 438), but also argued that faunalturbation was the (major) agent responsible for post-depositional, downward artefact movement mixing up the remains from both occupation phases, "even though there are anomalies in the results obtained" (Bubel, 2003: 438). Her study did not include the refit-dataset available for this site (including at least 123 refit-sets comprising at least 355 artefacts) apart from the observation that "several refits span across more than 4 m [on the horizontal distribution plan]" (Bubel, 2003: 425) and the remark that "it would be extremely difficult to separate out the two occupations, if in fact there are two, but refitting projects would significantly help in doing so" (Bubel, 2003: 425).

At the site of Liège – Place Saint-Lambert (secteur S.D.T.), van der Sloot (1999: 76) used the vertical distribution of refitted (patinated) artefacts to support a single occupation hypothesis in combination with important vertical migration. While published refit-data from this site unfortunately remains scarce, his claims were based on a refit-set with 32 artefacts dispersed over and beyond the entire humiferous stratum considered to be the Mesolithic level. In a subsequent paper, following additional excavations at Place Saint-Lambert, typological and radiometric arguments were put forward to refute the initial idea of a single occupation, distinguishing instead between at least two phases of later Mesolithic occupation (van der Sloot *et al.*, 2003: 88). On the other hand, the hypothesis of vertical artefact migration -*difficile à quantifier avec précision*- was more or less repeated, based on the important vertical distribution of lithics across different geological strata and the presence of some refit-sets including artefacts from different lithostratigraphic units. At the same time, the dominance of short-distance refits in the horizontal plain was considered to be suggestive for the (near) absence of artefact displacement (infra).

Vermeersch (2013: 22) pointed at a 'significant' vertical distribution of artefacts from two refit-sets to suggest not only that artefact distribution at different sectors of the multi-cluster site of Zonhoven – Molenheide is related to the presence of a cobble-gravel layer, but also that "artefact depth is not related to a succession of deposits covering artefacts which were produced during a single event" and that "vertical distribution is apparently the result of postdepositional activity". Adjoining graphs of both refit-sets, each containing 12 elements but without their refit-lines, show that the vertical distance of the artefacts amounts to 40 cm (for refit 181) and 60 cm (for refit 142). Unfortunately, no further details are provided for the former refit-set. The latter one (refit-set 142) is discussed in detail (Vermeersch, 2013: 68-69) and contains "32 flakes and fragments conjoining with the core" (mostly from a dense scatter in the NW-sector of the site), in contrast to the graph on its vertical distribution which depicts only 12 of its elements.

Noens and Crombé (2012: 247) combined refitting of lithic artefacts from different depths with raw material characteristics and patination to emphasize the importance of vertical artefact displacement at cluster C3 from Doel – Deurganckdok sector J/L (DDD-C3). The wide vertical distribution of clearly identifiable lithic raw material varieties as well as the recurrent co-occurrence of patinated and non-patinated artefacts in many refit-sets (including direct links between patinated and non-patinated fragments, the regular intercalation of patinated artefacts in non-patinated sequences and the total lack of entirely patinated sequences) were considered to be strong arguments in support of this point of view. The refit-dataset of DDD-C3 is one of the most extensive intracluster datasets currently available for the Belgian Mesolithic, with over 1.500 artefacts as part of 304 refit-sets for a collection of nearly 14.600 lithics (3.6 kg). It is one of the four Mesolithic refit-collections for this area that include over 400 artefacts, next to the intercluster datasets from Zonhoven – Kapelberg (414 artefacts in 150 refit sets; Huyge, 1985, 1986; Van Litsenborg, 1999; Janssens, 2004), Kerkhove – Stuw WP 1 (1.052 artefacts in 271 refit sets; Crombé *et al.*, 2019; Vandendriessche & Crombé, 2020), and Zonhoven – Molenheide (1.825 artefacts in 532 refit sets; Rots, 1996; Vermeersch *et al.*, 1996; 1998; Peleman & Vermeersch, 2002; Vermeersch, 2013). The dataset from DDD-C3 comprises 11 % of all recovered artefacts (or 70 % of the total weight), amounting to 28 % when excluding the ca. 9.000 chips that were largely ignored during refitting. Most refit-sets contain only a limited number of artefacts (i. e. 81 % are sets with five or less pieces), but ca. 10 % of the sets has over 10 artefacts, with two sets exceeding 50 elements. The mean number of artefacts per refit-set is 5. The number of 'direct' refit-lines between two artefacts in a refit-set (i. e. providing a direct physical contact between the two artefacts) is 2.282, with an additional 8.618 'indirect' connections (i. e. both artefacts belong to the same refit-set -thus providing data on their temporal and spatial relationships- but lack a direct mutual physical contact and are only connected indirectly through other artefacts from the set). Over 62 % of all refit-lines are ventral-dorsal refits, whereas another 18 % link two broken fragments (with 6 % fractures resulting from exposure to heat), and 6 % are ventral-core connections, apart from some other types of fracture (e. g. bulb(ar) flakes, burin blows, chunks, frost fractures, etc.).

Most lithics from DDD-C3 were collected through systematic wet-sieving using square excavation units of 0.25 m² and 5 cm-spits (according to a stepped system as is a common strategy for Mesolithic excavations in the Low Countries), amounting to a total excavated depth of 45 cm. The stepped system implies that only from the upper 10 cm all squares were removed, while for the lower levels progressively less units were excavated. The decision to excavate a square for the lower layers was made on the spot intuitively by ear based on the cracking sound of the lithics against the shovel, taking into account a wide margin to make sure that the (near) total vertical distribution was reached (oral communication Sergant J., 2010). However, post-excavation analysis of the number of lithics in each lower square unit indicates that this margin was not always as wide as presumed during the course of fieldwork, with implications for subsequent spatial analyses. Keeping in mind this potential drawback, the vertical distribution of lithic artefacts at DDD-C3 shows a unimodal curve with the highest peak at a depth of

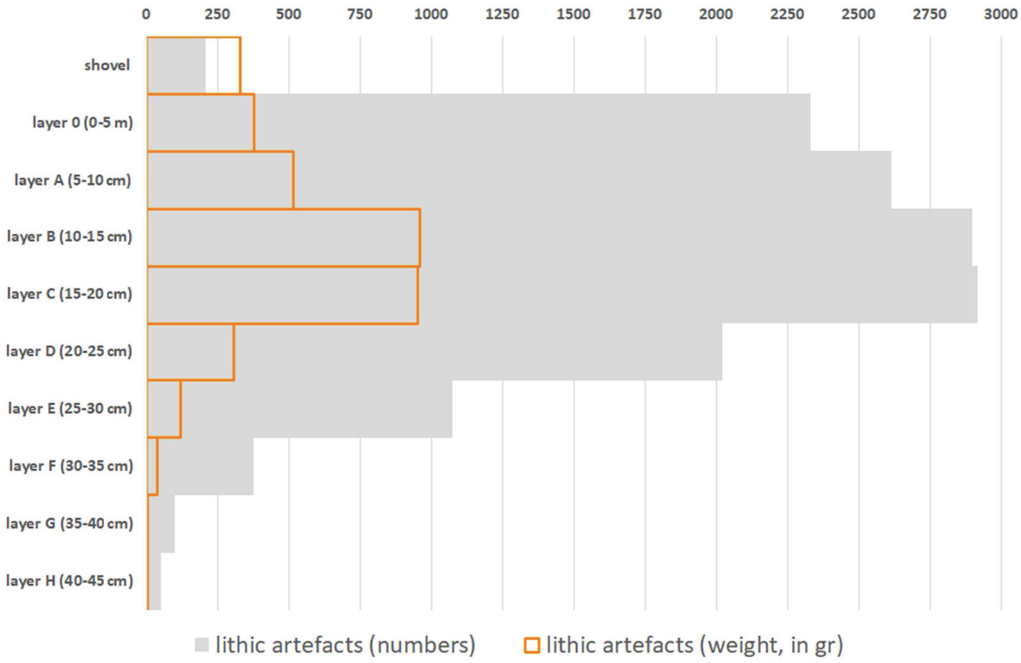

Fig. 2 – Vertical distribution of lithic artefacts at DDD-C3, expressed in numbers and weight.

10-20 cm including 40 % of all lithics, while the entire upper 20 cm has 75 % of all lithics (Fig. 2). Below 25 cm the number of lithics drastically drops (but it remains difficult to assess to what extent this pattern is influenced by excavation procedures).

Refitted artefacts from DDD-C3 occur at all layers (Fig. 3), but in variable percentages (Fig. 4). Excluding the -usually larger- shovel finds, 40 % of which are part of a refit-set, between 6 and 12 % of the sieved artefacts from each layer belongs to a refit-set. These values rise to 18-30 % when excluding chips and to 13-74 % when expressed in artefact weight. For layers below 20 cm, the number of refitted artefacts per layer slightly drops (i. e. from a mean value of 11 % for the upper layers to 8 % for the lower layers, or from 28 to 21 % when excluding chips). This drop is more significant when expressed in weight, i. e. from a mean value of 68 % for the upper layers to a mean value of only

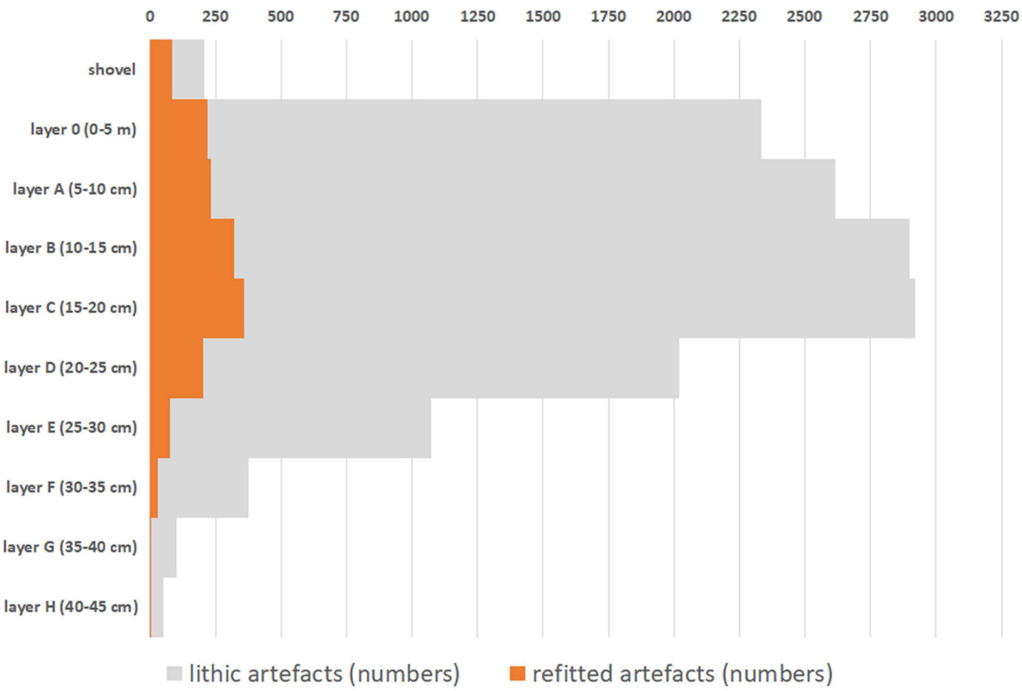

Fig. 3 – Vertical distribution of refitted artefacts (orange) compared to all lithic artefacts (grey) at DDD-C3.

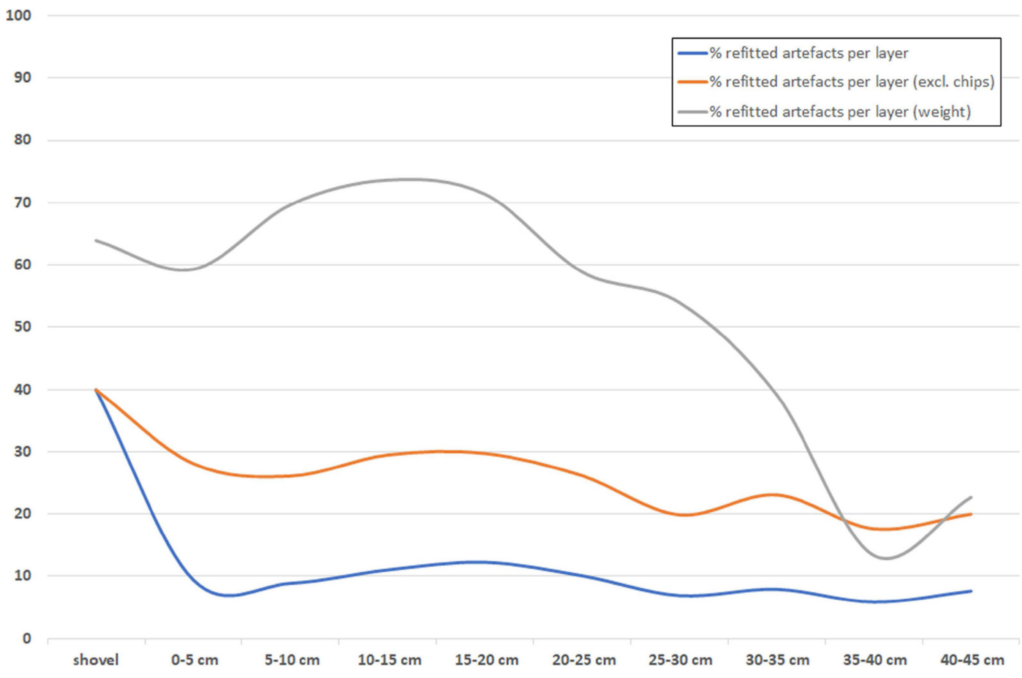

Fig. 4 – Percentage of refitted artefact per layer at DDD-3.

38 % below 20 cm. Whether it is related to possible size sorting effects (with a larger percentage of smaller artefacts to be found in lower layers) and/or with excavation procedures (i. e. the stepped system), or a combination of both, requires further study beyond the scope of this paper.

Artefacts from different depths are intensively interconnected, as is clear when either all refit-lines or only the direct ones are considered. Over 82 % of all refit-lines connect artefacts from different layers, the remaining part being links between artefacts from the same layers. Focussing only on the direct lines, this number is comparable (80 %; Tab. 1). With few exceptions (i. e. the '0'-values in the table), lithics from all depths are directly connected to one other. When including the indirect refit-lines this pattern is even stronger as only the lower layers are not interconnected, probably due to the low number of excavation squares (N = 24 or 3 % of all excavation units) as well as the low number and small dimensions of the artefacts recovered from these layers (N = 153 or 1 % of all artefacts; 0.2 % when expressed in artefact weight). Half of the direct refit-lines -including connections between objects from the same level- link up artefacts from levels situated within 10 cm of each other, while only 11 % of the direct refit-lines connect artefacts from levels that are separated at least 20 cm apart. In other words, nearly 90 % are vertical connections of less than 20 cm, occurring at all depths.

	Shovel	*0-5 cm*	*5-10 cm*	*10-15 cm*	*15-20 cm*	*20-25 cm*	*25-30 cm*	*30-35 cm*	*35-40 cm*	*40-45 cm*
Shovel	10	25	47	58	79	38	15	6	0	0
0-5 cm	-	56	95	137	113	73	29	10	0	0
5-10 cm	-	-	53	142	165	89	35	12	1	1
10-15 cm	-	-	-	126	210	117	44	23	2	2
15-20 cm	-	-	-	-	153	131	61	15	0	1
20-25 cm	-	-	-	-	-	38	30	12	4	2
25-30 cm	-	-	-	-	-	-	6	5	1	1
30-35 cm	-	-	-	-	-	-	-	2	1	0
35-40 cm	-	-	-	-	-	-	-	-	1	0
40-45 cm	-	-	-	-	-	-	-	-	-	0

Tab. 1 – Interconnection of direct refit-lines between the different layers at DDD-C3.

Apart from a single direct connection between an object from level 5-10 cm with one from level 40-45 cm, no direct links occurs between artefacts situated in levels of at least 35 cm apart. Whether this pattern of an overall limited vertical distance between any two linked artefacts reflects some kind of latent stratigraphy (possibly reflecting multiple occupations as suggested by radiocarbon dating, i. e. Noens *et al.*, 2006; Noens & Crombé, 2012; Noens, 2013) requires further analysis. A visual impression of this extensive interconnection of artefacts from the different levels through direct refit-lines, distributed over the entire excavated depth, is shown in figure 5.

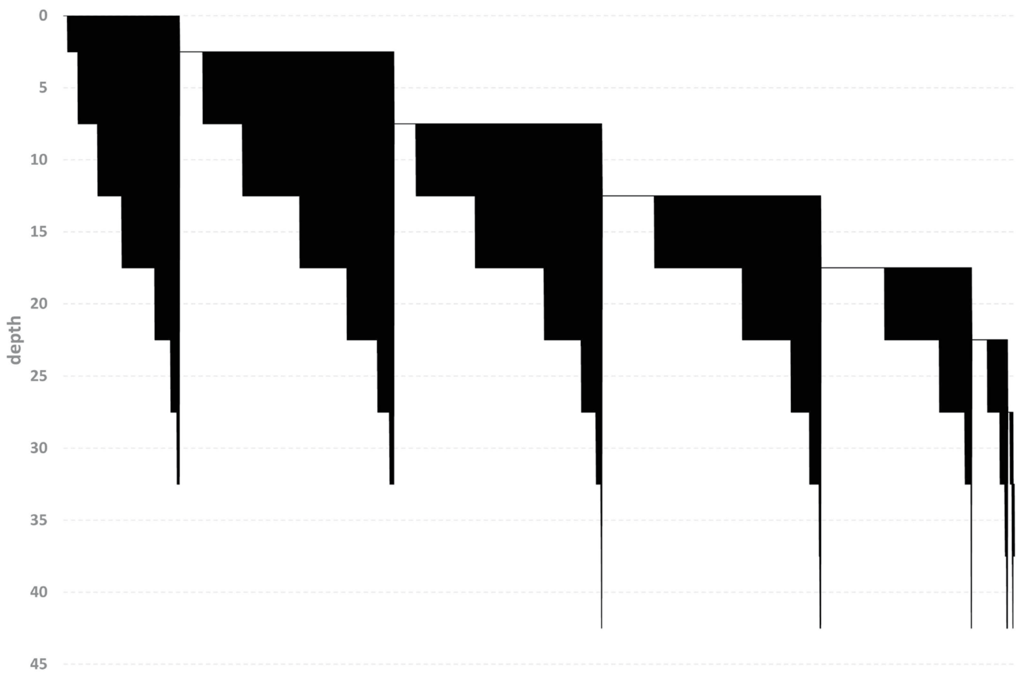

Fig. 5 – Impression of the extensive interconnection of artefacts from the different level through direct refit-lines at DDD-C3.

Each refit-line between any two artefacts has a temporal dimension that differs according to the type of fracture. When a flake breaks into two fragments, either during or after its creation and regardless of the cause, both fragments are created simultaneously, i. e. during this moment of fracture. Relative to each other, both refitted fragments can thus be considered as contemporaneous, regardless of any subsequent modifications to one or both of the fragments. At the moment of fracture both elements connected by the refit-line were located at the same place (i. e. at the same surface), which is not necessarily the case for a ventral-dorsal type of connection (infra). This implies that when refitted broken fragments are found at different levels, they must have been vertically displaced at a moment postdating their moment of fracture. The group of break-connections between fragments found at different levels, therefore, can act as a strong indication for (post-depositional) vertical movement, particularly when such connection types are present in large quantities and occur all over the artefact cluster. Around three-quarters of the nearly 700 direct break-connections at DDD-C3 were recovered from different levels, as shown in table 2, providing a strong argument for vertical displacement within this cluster. But as was the case for all direct refit-lines (supra), only a minority of around 10 % concerns vertical distances larger than 20 cm with a near absence of links spanning the entire depth.

In contrast to breaks that simultaneously create at least two broken fragments (also including heat-induced fractures, retouching, the creation of bulbar flakes, burin-spalls or microburins, etc.), ventral-dorsal connections between two flakes have a different

	Shovel	*0-5 cm*	*5-10 cm*	*10-15 cm*	*15-20 cm*	*20-25 cm*	*25-30 cm*	*30-35 cm*	*35-40 cm*	*40-45 cm*
Shovel	3	7	12	22	21	12	2	3	0	0
0-5 cm	-	29	27	36	32	28	12	6	0	0
5-10 cm	-	-	19	29	34	21	8	4	0	0
10-15 cm	-	-	-	42	55	39	13	6	2	1
15-20 cm	-	-	-	-	59	46	18	3	0	0
20-25 cm	-	-	-	-	-	18	11	6	1	0
25-30 cm	-	-	-	-	-	-	6	1	0	0
30-35 cm	-	-	-	-	-	-	-	2	1	0
35-40 cm	-	-	-	-	-	-	-	-	0	0
40-45 cm	-	-	-	-	-	-	-	-	-	0

Tab. 2 – Interconnection of (direct) break refit-lines between the different layers at DDD-C3.

temporal dimension as these connection types do not necessarily indicate a simultaneous creation of both artefacts, and in fact most often do not. Except in the case of a refit between a flake and its secondary flake(s), created more or less at the same time during a single force of impact (i. e. by means of percussion or pressure), one of the flakes will always be created before the other, with an unknown time-lag between the two. In other words, the second artefact does not yet exist (but is still part of the core) at the moment the first one is detached from the core. Given this potential time-lag between the creation of both objects, both flakes are not necessarily created at the same spot or in the same stratigraphic position, in contrast with two broken fragments. But, an older flake recovered from a level above the more recent connecting flake becomes a strong indication for vertical displacement, much more so than when both are recovered from the same level or when the older flake is situated below the more recent one (following the principle of stratigraphy). Here, too, the case for vertical displacement becomes stronger if many connections with older artefacts above younger artefacts are present in the dataset. Being the case for around 40 % of the nearly 1.300 direct ventral-dorsal links at DDD-C3, connecting well over a thousand (fragments of) flakes, this part of the dataset forms another strong support for the importance of vertical artefact displacement at this cluster. Additional support is provided by the indirect type of ventral-dorsal connections, where both flakes from the same refit-set do not touch each other but, nevertheless, do have a clear temporal relationship. From the 6.767 indirect ventral-dorsal refit-lines, nearly one-third (32 %) are cases where an older artefact was found in a level above a more recent one.

Despite their scarcity at many sites, larger refit-sets are another useful line of evidence -and indeed have been used extensively (supra)- to gather data on the mechanisms behind the vertical dispersion of artefacts, because of the large numbers of artefacts and (in) direct refit-lines involved. Usually, a technological reconstruction of the reduction sequence (different scenarios of which are possible) provides sufficient evidence for the temporal succession of its composing elements, and these reconstructions of the reduction sequences can then be compared to the vertical distribution of the artefacts that were sorted in time relative to one another. If this chronology of removal does not follow stratigraphy (i. e. older artefacts from the refit-set are found above younger elements from the same set, or all elements come from the same level), then one has another strong argument in favour of vertical artefact displacement, as was the case for the level of refit-lines (supra). DDD-C3 has 34 refit-sets containing over 10 artefacts, representing a total of 736 refitted artefacts. The four examples provided in figures 6 to 9, connecting between 19 and 51 artefacts from different depths in a random manner, confirm the observations from the other lines of evidence in support of the importance of (post-depositional) vertical displacement of artefacts at this cluster.

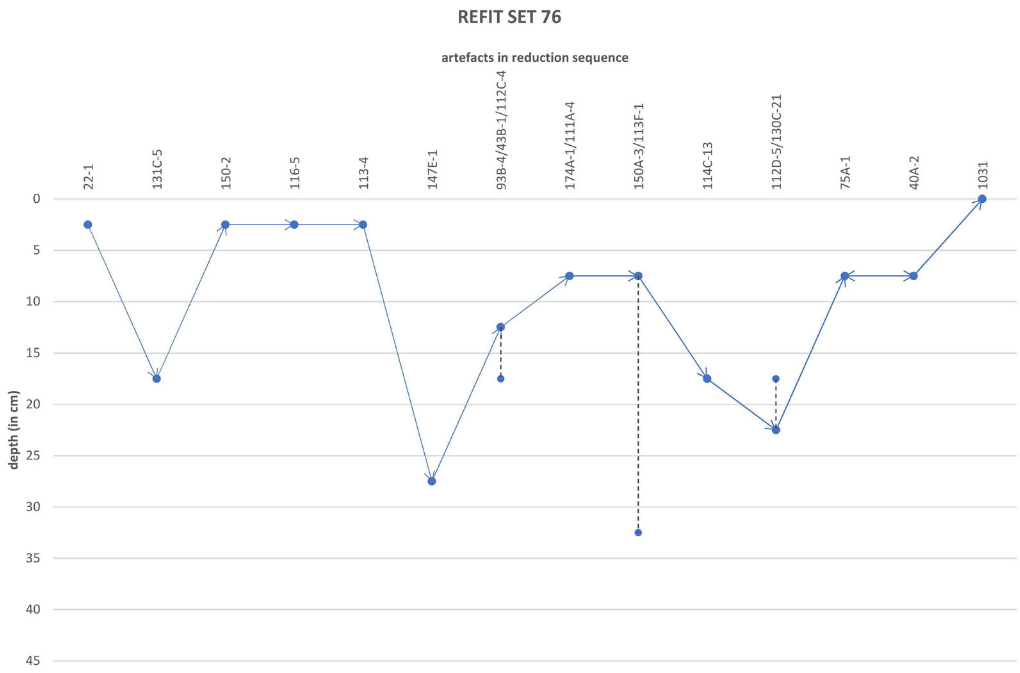

Fig. 6 – Vertical distribution of the chronologically ordered elements of refit-set 76 at DDD-C3.

3. *Refitting and lateral displacement*

Post-depositional vertical movement of lithic artefacts was not the only focus of taphonomic refitting at Belgian Mesolithic artefact clusters. Since the mid 1980's lithic refitting has equally contributed in several ways to questions of lateral artefact displacement due to recent ploughing activities or slope erosion processes (e. g. Gob & Jacques, 1985; Lausberg-Miny *et al.*, 1985; De Bie *et al.*, 1992; Votquenne, 1992-1993; van der Sloot, 1999; Janssens, 2004; Crombé *et al.*, 2019). Several of these studies link short-distance refit-lines with the (near) absence of lateral artefact displacement. The proximity of 'several' refitted broken fragments at Remouchamps – Station Leduc, which yielded over 1.840 lithic artefacts, led Gob & Jacques (1985: 165) to conclude that "[l]ateral displacement of artifacts appears to be very limited". Around the same time, limited displacement was also inferred by

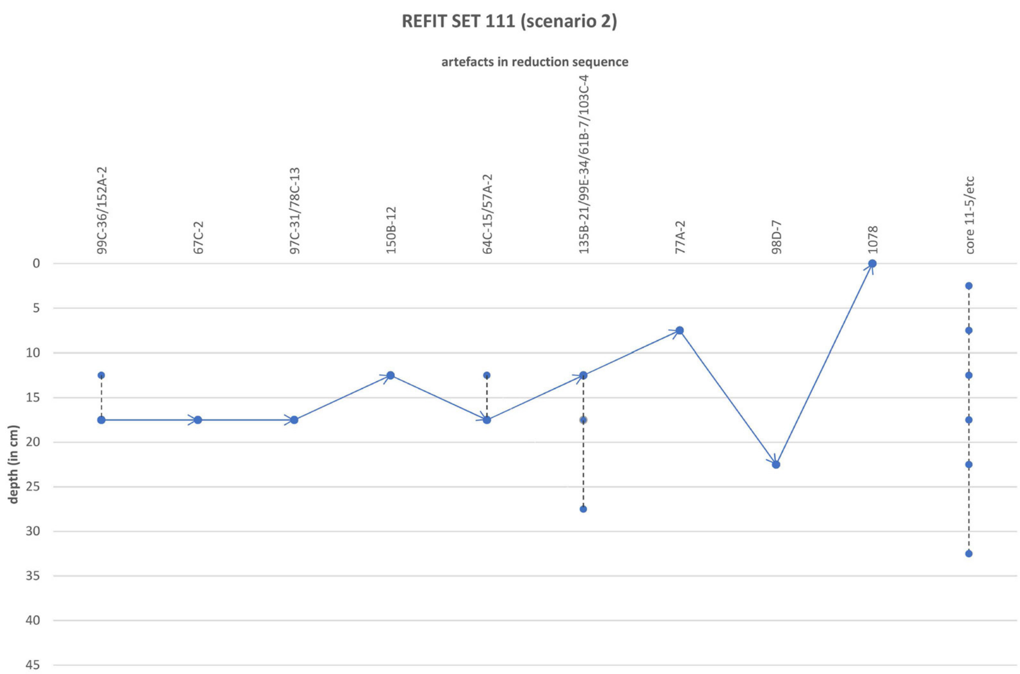

Fig. 7 – Vertical distribution of the chronologically ordered elements of refit-set 111 at DDD-C3.

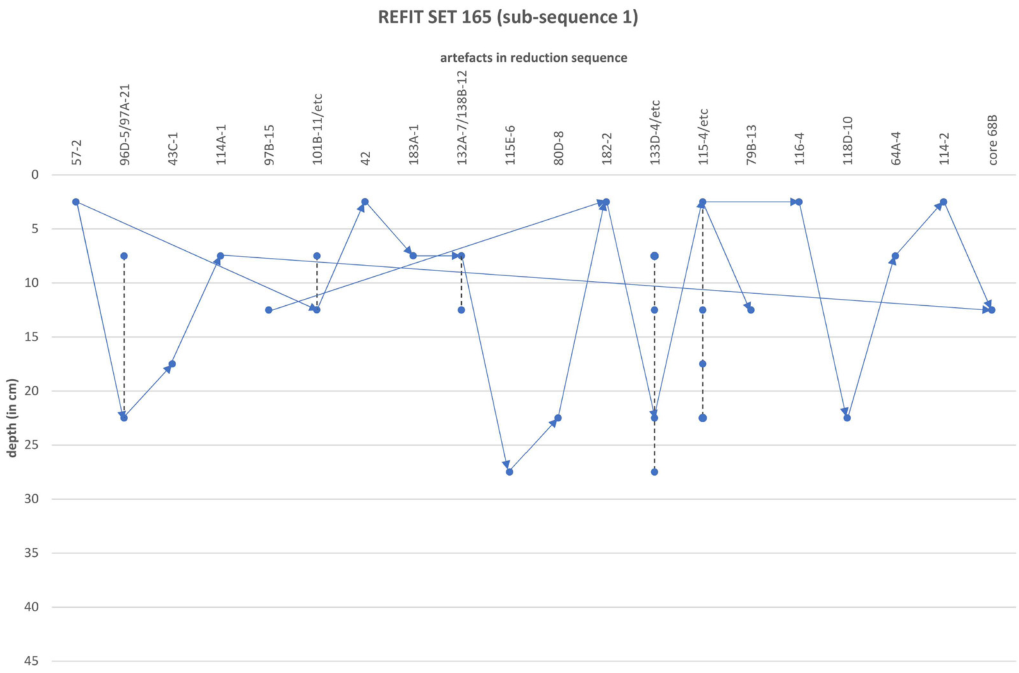

Fig. 8 – Vertical distribution of the chronologically ordered elements of (part of) refit-set 165 at DDD-C3.

Lausberg-Miny *et al.* (1985: 56-57) for Kelmis – Brenn Hag (2.778 artefacts), who used refitting of lithics from a single pit, as well as links with artefacts from the present-day surface as argument. However, for both collections the number of refitted artefacts and refit-sets underlying the statements, as well as the precise distance between refitted artefacts remains unknown. Limited refitting at the ploughed site of Assent-Luienberg, including a handful of conjoined artefacts recovered from the same excavation units and some physical connections of surface-collected with excavated lithics, led De Bie *et al.* (1992: 12) to argue for a limited post-depositional displacement linked to agricultural activities, because of the short distances of the refitted artefacts which were mostly recovered from the same excavation squares. From a total of nearly 800 artefacts, around 2 % were refitted into at least seven refit-sets. Similarly, Van der Sloot (1999: 76) suggested limited horizontal displacement of lithic artefacts at Liège – Place Saint-Lambert (secteur S.D.T.)

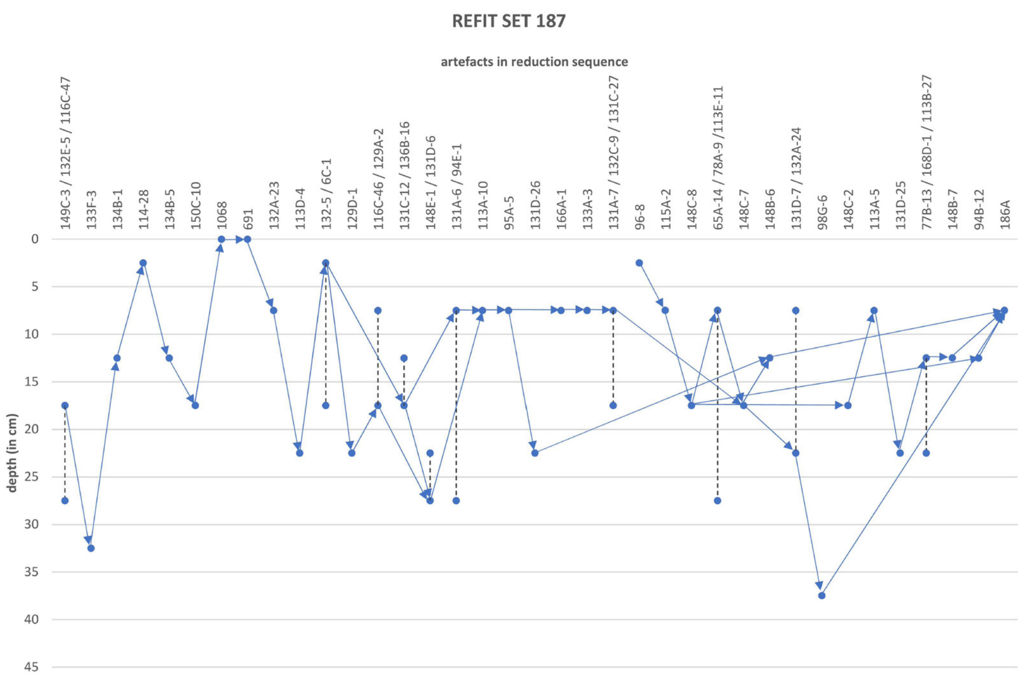

Fig. 9 – Vertical distribution of the chronologically ordered elements of refit-set 187 at DDD-C3.

based on a single refit-set including 32 artefacts recovered from adjacent excavation units. Despite major vertical displacement, as evidenced from connection of lithics from different lithostratigraphical units (supra), van der Sloot *et al.* (2003: 88) subsequently repeated that part of this site remained excluded from major post-depositional artefact displacement, again referring to the same refit-set (this time including 41 elements or 0.3 % of all recovered artefacts) and pointing at the predominance of its short-distance refit-lines as well as an 'exceptional' clustering of 18 nucléi in the same area.

Whereas short distances between refitted artefacts are interpreted in terms of limited lateral artefact displacement, large-distance refit-connections are used in several refit-studies to infer the importance of lateral movement. Under the assumption that broken lithics are no longer usable and thus usually left on the spot instead of being voluntarily moved by humans, Votquenne (1992-1993: 112-115) used refitting of broken fragments as a tool to assess displacement due to natural causes at the massive collection of Sougné A – Walter Fostier, yielding well over 68.000 artefacts. He initially focused on a sample of 600 microlith fragments followed by a sample of 3.000 bladelet fragments only to find a disappointing number of eleven refit-sets, including 22 refitted fragments. Recognizing that his limited dataset of 11 refit-lines did not warrant far-reaching conclusions for this collection, he nevertheless observed some long-distance connections (up to 13 m) and noted a 'tendency' for these few refit-lines to follow the slope of the terrain. This led him to conclude that this slope together with agricultural practises were important causes not only for post-depositional artefact movements but also for the creation of artificial clusters. Janssens (2004: 82-89), for his part, used refitting in combination with statistics to argue for lateral displacement of lithics at the ploughed site of Zonhoven – Kapelberg. Albeit not evident from the two different distribution maps he cites in support of his argument (Janssens, 2004: fig 32 + plaat VIII), most refit-lines between artefacts from below and artefacts from within the plough layer - labelled as 'in-situ' and 'displaced' artefacts- were said to show a similar direction, both within and between artefact clusters. To him this indicates a post-depositional shear movement of artefacts in a south-westerly direction, possibly even from one cluster to another as some intercluster refits seem to suggest. However, and in line with many other refit-studies, it remains unclear how many of the 414 refitted artefacts (ca. 9 % of all artefacts) and 150 refit-sets were actually involved to support his argument.

Downslope movement of lithics was recently put forward as a hypothesis for the multi-cluster site of Kerkhove – Stuw WP1, particularly along the southern slope of a buried levee where colluvial deposits were found (i. e. a ca. 40 cm thick slope deposit radio-carbon dated to the late Preboreal-early Boreal). These deposits were assumed to be partly contemporaneous with archaeological remains recovered at the top of the levee. The hypothesis of lateral, downslope displacement of lithics was first presented in the excavation report (Sergant *et al.*, 2018: 531- 533) where it was tested by looking into size sorting effects along two sections. The eastern, small section of 5 x 20 m included two small and low-density clusters comprising a total of 580 artefacts, apart from an unknown number of lithics beyond their artificial boundaries (see Sergant *et al.*, 2018: 528 + fig. 3.2.3.2.1; Crombé *et al.*, 2019: fig. 7). Both clusters were considered to be 'potential pseudo-clusters from colluvial deposits along the slope of the levee' (Sergant *et al.*, 2018: 529). Two observations in this eastern trench were deemed important (Sergant *et al.*, 2018: 533). First, the 'remarkable' observation that most artefacts from the trench were recovered near the foot of the slope, instead of higher up, was tentatively linked to 'debris flow', although the possibility of in-situ deposition was not excluded. Second, it was observed that a considerable percentage of artefacts larger than 1 cm from the clusters were still encountered at depths of 25 cm, which was argued to be an important difference compared to the vertical distribution within other clusters, albeit no further data on this aspect was provided. Despite both observations, no clear patterning reflecting slope processes were found when the vertical distribution of artefacts smaller and larger than 1 cm along the two sections following the slope were compared (nor was it made clear what kind of patterns actually are to be expected). To Sergant *et al*., lithic refitting was needed to provide any clues for downslope movement of artefacts in this trench. In their subsequent study of the relationship between humans, forest fires and erosion during the Early Holocene at this site, Crombé *et al*. (2019: 87, 89) returned to this issue of downslope movement along the southern slope and foot of the Late glacial levee, using a sample of the refit-data from the eastern trench as one of their lines of reasoning, next to a high-resolution, multi-proxy analysis of the slope deposit itself (comprising a study of pollen, plant macroremains and charcoal as well as micromorphology, loss-on-ignition, radiocarbon dating, and grain-size analysis). Their taphonomic refit-study solely relied on the orientation of refit-lines, not considering distance or type of these lines. Over 70 % of the refit-lines in their sample, connecting 86 lithic artefacts, were said to be "oriented in the general direction of the slope", as was visualized by means of a wind rose diagram (Crombé *et al*., 2019: fig. 8). In addition, Crombé *et al*. observed "much less sharp and more diffuse" southern boundaries for some of the clusters along the slope. From these observations, downslope artefact movement as a result of runoff was inferred, suggesting that "it seems unlikely that this disproportionate amount of artefact movements along the slope could be the consequence of anthropogenic actions" (Crombé *et al*., 2019: 87) and that "part of the lithic artefacts [...] originates from occupation levels on the top of the levee and was washed down towards the levee base" (Crombé *et al*., 2019: 89).

4. Discussion

The most important argument that has been used to infer vertical artefact movement at Belgian Mesolithic sites by means of lithic refitting is the physical connection of objects from different depths, regardless of the type of fracture involved. Sometimes this argument is complemented with one of chronological order of the refitted artefacts, either at the level of individual refit-lines or at the level of entire (and usually larger) refit-sets. Sporadically, additional arguments, such as artefact size sorting or weight distribution, patination and raw materials characteristics are also included into the inferential process. When the argument of a physical connection of artefacts from different depths is used, it usually -yet not exclusively- focuses on the more extensive refit-sets. The underlying assumption of this argument, first made explicit by Moeyersons for Meer II, is that artefacts from a same refit-set are contemporaneous. Yet, this assumption, omnipresent in refit-studies worldwide to argue for single occupations, is not necessarily always valid and in fact only applies to breaks (i. e. fragmentation due to thermal or other non-knapping mechanical processes resulting in proximal, mesial, distal, lateral and/or multiple fragments), flake-on-core refits and edge modifications (i. e. burin spall on burin; retouch chip on retouched artefact), but not to ventral-dorsal types of refits (e. g. flake-on-flake). The type of refit-line thus introduces the argument of chronological order. In the former cases both fragments are created at the same time, which is the moment of fracture. In the case of ventral-dorsal refitting, on the other hand, the more recent object from the refit-set (e. g. the one where the common fracture plane is part of the dorsal surface) usually does not yet exist at the time when the older artefact (e. g. the one where the common fracture surface is -part of- the ventral surface) is created, except during the more or less simultaneous creation of secondary flakes. This time-lag between the creation of the oldest and the youngest artefact can vary from very brief (e. g. seconds) to long (e. g. millennia). This temporal aspect of different types of fractures and refit-lines should always be considered, yet too often remains obscure from the publications. In the case of ventral-dorsal (and to a lesser extent also ventral-core) refit-types, where there usually is a certain time-lag between the creation of both objects, the observation that the oldest artefact (i. e. the one removed first from the core) is found at shallower depth compared to the more recent one (i. e. the one removed later from the -more reduced part of the- core or the remnant core itself) is an important element to support a vertical displacement after both objects were created. This, however, does not apply to the cases where the older artefact is found below the younger one, or where both are found at the same level. In the case of fragmentation due to breaks, where both fragments were created at the same time, the observation that both were recovered from different levels becomes an important argument in support of a vertical displacement after the creation of both fragments.

While theoretically solid arguments, similar to the axiom of stratigraphic superposition in geology and archaeology (i. e. in undeformed stratigraphic sequences, the oldest strata will be at the bottom of the sequence), their strength is often weakened by the small number of refits and their restricted lateral dispersion involved in the argumentation, posing issues of representativity and extrapolation, given that many processes can result in local disturbances. As far as can be reconstructed from published accounts, and with some exceptions, the number of refit-sets underlying the inferential processes on vertical artefact dispersion is restricted, and generally only considers a small portion of the entire refit-dataset. Cahen's initial interpretation of Meer II is based on 51 artefacts from 13 refit-sets, all from a restricted area along the southwestern edge of the excavated area, situated beyond the limits of the artefact clusters. This dataset represents merely 0.3 % of all recovered artefacts and 1.7 % of the refitted artefacts from this site. Apart from two larger refit-sets with 10 and 15 artefacts, it consists of short sequences of two, three or four objects. From the 24 depicted refit-lines, 15 from six refit-sets are ventral-dorsal connections, only five of which do not respect the order of removal, a small number given that this removal chronology is one of their main arguments. The updated version of this study by Van Noten *et al.* (1980b: 47) was even based on a smaller refit-set, including only 44 refitted artefacts and 32 connection lines from 12 refit-sets. The large refit-set with 15 artefacts from the original graph (for which no refit-lines were reconstructed; Van Noten, 1978: fig 13) was excluded in the version presented by Van Noten *et al.*, whereas the other large refit-set with 10 elements from the original graph was extended to include 18 artefacts. Spaens (1983: 85) depicted still another version of the same graph, relying on the original one by Cahen but excluding his 15-artefact refit-set for which no refit-lines were reconstructed. For Neerharen – De Kip, Lauwers & Vermeersch used only a single refit-set with 33 artefacts, representing 20 % of all refitted artefacts but only 1 % of all recovered artefacts. The total number of refit-sets from this site remains unknown. For Donk – Krikeldries little information on the number of refitted artefacts and refit-sets is available, except that they are few in number. The inference of vertical migration of artefacts at Helchteren – Sonnisse Heide 2 relies on 43 artefacts from only two refit-sets, representing 16 % of all refitted artefacts and a mere 1.4 % of all collected artefacts. Here, too, the total number of refit-sets is unknown. For Brecht – Moordenaarsven 37 artefacts from six refit-sets were used, representing 10 % of all refitted artefacts, 0.2 % of all recovered artefacts and -at most- 5 % of all refit-sets. The single refit-set with 32 artefacts from Liège – Place Saint-Lambert, from an unknown number of refitted artefacts and refits-sets, represents only 0.3 % of all recovered artefacts, and both refit-sets from Zonhoven – Molenheide account for 1.3 % of all refitted artefacts and 4.5 % of the refit-sets (the total number of excavated artefacts at this site is unknown). The figures are similar for the refit-studies on lateral artefact displacement. For Remouchamps and Kelmis – Brenn Hag no reliable data are available. For Assent – Luienberg the interpretation relies on ca. 2 % of the recovered artefacts. The 86 artefacts belonging to an unknown number of refit-sets from the eastern trench at Kerkhove – Stuw WP1 represent 8 % of the refitted artefacts from this site and only 0.3 % of all recovered lithics (large parts of which are smaller chips). The small refit-datasets upon which most of the inferences on artefact displacement are based, ignoring large parts of the collections and/or refit-sets, are important to consider in any of the interpretations put forward. Yet, despite these restrictions, the refit-studies presented above seem to indicate that post-depositional migration may be a widespread mechanism that resulted in vertical dispersal of artefacts at Belgian Mesolithic sites. Yet, refitting does not offer any reliable data on the processes and agents behind these migrations. Furthermore, this interpretation of a widespread post-depositional artefact displacement obviously does not exclude the possibility of multiple occupations at each of these sites, despite ubiquitous claims of single-occupation sites.

Refit-studies focussing on lateral artefact displacement at Belgian Mesolithic sites generally rely on the length of refit-lines (i. e. the straight and thus shortest horizontal distance between two refitted artefacts) and/or their orientation. Assumptions underlying these two types of data are that large(r) distances and/or similar (i. e. downslope) orientations of these refit-lines are indicative for lateral displacement, whereas short(er) distances and/or more random orientations of the lines reflect a (near) absence of such displacements. However, numerical values for 'short' or 'long' usually are restricted. Contrary to refit-arguments put forward to infer vertical artefact displacement, those for lateral movement are usually more ambiguous and lack a sound theoretical and conceptual framework, given that many processes can be invoked to explain similar horizontal distribution patterns of refitted artefacts. In other words, many of these studies fail to make explicit what kind of refit-patterns are to be expected for lateral displacement and how these patterns can be reliably differentiated from those created by other formation processes.

Downslope artefact movement as proposed by Sergant *et al.* (2018) and Crombé *et al.* (2019) for Kerkhove – Stuw WP1 can be viewed as a plausible hypothesis for artefacts along the southern slope of the levee with its colluvial deposits, given the evident slope towards the paleochannel. In our opinion, the argument from refitting (i. e. a predominant orientation of refit-lines in the general direction of the slope) is not (yet) a convincing one, for several reasons. As in most other refit-studies on lateral movement of artefacts it remains poorly argued which refit-patterns are expected to account for downslope movement, but also how such patterns can be differentiated unequivocally from those created by other processes of artefact deposition and displacement, particularly because in-situ deposition at the foot of the slope, instead of 'debris flow', was also put forward as a viable hypothesis and because no size-sorting patterns reflecting slope processes were observed (whatever such patterns may be, supra). Which refit-patterns unequivocally reflect downslope movement ? A map of the horizontal distribution of (some of) the refit-lines from the eastern trench (Crombé *et al.*, 2019: fig. 8) reveals a general impression of the distribution of refit-lines. A comparison between the maps by Crombé *et al.* (2019: fig. 8) and Vandendriessche & Crombé (2020: fig. 2) shows, however, that not all refit-lines from this trench were included. Apart from this partial distribution map no numerical data on distances of the refit-lines was provided, nor any information on the number of refit-sets or type of refit-lines involved in the argument. The latter is particularly important, given that the visualization of length and orientation of refit-lines reflecting reduction sequences (i. e. ventral-dorsal refits or ventral-core refits) depends on the elements that are present or absent from the refit-set, in contrast to refit-lines between broken fragments whose distance and orientation always simply depend on the location of both fragments. Given that complete refit-sets (i. e. sets that allow the entire original nodule to be reconstructed) are nearly always lacking at Belgian Mesolithic sites, the addition of any new element to a refit-set, for instance a third flake between a ventral-dorsal refit of two flakes, can significantly alter the number, length and orientation of refit-lines from that set. In other words, an interpretation and visualization of ventral-dorsal types of lines, in contrast to break refit-lines, seems to be less straightforward for this kind of taphonomic refitting. We, therefore, wonder whether a study of slope movement by means of refitting should not better separate break refit-lines from ventral-dorsal lines and first focus on the former group (as for instance was done by Votquenne in his study of Sougné A) ? And would it not also be interesting to include data on the vertical dispersion, distance and type of refitted artefacts? Another potentially blurring element in the dataset presented by Crombé *et al.*

concerns their wind rose diagram. Not only does it seems to depict a mere 50 instead of 56 refit-lines (whereas the text reads: "Up to 70 % of the resulting refit lines (n = 56) are oriented in the general direction of the slope"), but more interestingly, the bars on the diagram indicating the orientation of the refit-lines each represent increments of 11.25°. Yet, artefacts at Kerkhove were recovered from 0.25 m^2 excavation units instead of point-provenience data (i. e. objects lack precise x-, y- and z-values), making the calculation of such angle increments at least a difficult exercise. As shown on the horizontal distribution map adjoining the wind rose diagram, the implicit assumption underlying the bars on this diagram is that all refitted artefacts were situated at the centre of each excavation unit (which obviously is an improbable and even impossible case). Yet, placing the artefacts near the edges instead of at the centre of the excavation units from which they were recovered might actually result in entirely different orientations easily exceeding the 11.25° boundary, an effect which becomes more important for short distance refit-lines (but numerical information on distances is lacking). In cases where refitted artefacts come from adjoining units this shift in orientation can even amount to 90°! What, then, is the effect of this implicit assumption on the wind rose diagram? Finally, we also wonder to what extent the shape and dimension of the (rather small) trench in combination with the nature of its artefact distribution has an influence on the refit-pattern, particularly in view of the fact that the (few) refit-lines excluded from the dataset, which are orientated more or less perpendicularly to the slope, extend beyond the edge of this rather small trench. How many refit-lines perpendicular to the slope (and more or less parallel to the short edges of the trench) are to be expected, given the small size of the trench and location of the artefacts? Taking into account the possibility that the artefact distribution did not end at the borders of this trench (a possibility which was not investigated during field work), one may wonder whether a dominance of refit-lines more or less along the long axis of the trench is not to be expected due to the small width and specific orientation of the trench and the particular artefact distribution within this trench. It would not only be an interesting exercise to compare the orientation (and distance) of this refit-lines with those from the rest of the site but also to transpose this trench to the other refitted clusters from the top of the levee, thereby for instance also changing its orientation, to further investigate these potentially confounding effects.

5. Conclusion

There is a wide consensus among prehistorians that post-depositional artefact displacement is an important process in the formation of the Belgian Mesolithic archaeological record. With its capacity to link lithic artefacts in time and space, and thus providing an additional observable dataset for complex lithic aggregates, lithic refitting -as part of an interdisciplinary intrasite approach- has an important part to play in tackling questions on post-depositional artefact movement. However, in doing so, refitting in itself is unable to identify the agents responsible for object displacement, as much as it is unable to make substantiated claims on the presence of short-term events or single occupations (whatever the meaning implied by these terms).

For the Belgian Mesolithic record, taphonomic refitting has so far been applied to a handful of sites where post-depositional vertical and lateral artefact displacement have been ascribed to bioturbation, slope erosion and/or agricultural activities, as was shown by this brief review. Taking into account various levels of observation, ranging from an individual direct refit-line between two artefacts to extensive refit-sets with multiple direct and indirect connections between its components, these refit-studies rely on different lines of reasoning, including length and orientation of refit-lines, and the connection of artefacts from different levels in relation to raw material varieties, artefact patination and/or chronology of artefact removal. The nature of refit-lines, and their corresponding temporal dimensions, are important elements to consider in the inferential process. In addition, refit-datasets underlying the interpretations generally remain small, raising complex issues of representativeness and extrapolation. Furthermore, theoretical frameworks and underlying assumptions often are poorly developed. It remains for instance unclear how we can differentiate patterns resulting from post-depositional artefact movement from those caused by other processes. Inferring lateral displacement also appears more complex when compared to vertical artefact movement. Lithic refitting, when based on a representative sample, can provide a solid base to make the leap from observed patterns of artefact distribution to inferred statements on artefact displacement.

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Abstract

Post-depositional artefact movement at Mesolithic sites in Belgium is nowadays a generally accepted hypothesis, usually taken for granted without further inquiry. These inferences on artefact movement rely on the observed vertical dispersion of artefacts in non-stratified sedimentary contexts and include vertical and lateral displacements due to faunalturbation, slope erosion or agricultural practises, amongst many other possible natural and human agents. Due to its capacity to link lithic artefacts in time and space, providing us with an important additional dataset to study the complex formation processes of lithic aggregates, lithic refitting plays a prominent role in tackling these inferences. Based on an extensive inventory of refit-studies from Belgian Mesolithic collections, this paper provides an overview of this particular group of 'taphonomic' refit-studies, including some previously unpublished data from the Early Mesolithic scatter C3 from the site of Doel – Deurganckdok sector J/L. We specifically focus on the inferential processes that lead from observations in the archaeological record to inferences about lithic artefact movement, including the nature and representativeness of the underlying refit-datasets. The main arguments used to infer post-depositional artefact displacement include (a combination of) the type, length and orientation of refit-lines, the physical link of artefacts recovered from different depths, the chronology of artefact removal within the reconstructed reduction sequences, as well as patination and raw material characteristics. Furthermore, our results indicate that the underlying conceptual frameworks are underdeveloped and that the refit-datasets underlying the inferences are generally small, posing issues of extrapolation and representativeness.

Keywords: Mesolithic, Belgium, lithic refitting, post-depositional displacement, formation processes.

Samenvatting

Post-depositionele verplaatsingen van artefacten uit Mesolithische artefactenclusters op Belgische bodem vormen onderdeel van wijdverspreide hypotheses die vandaag de dag zelden nog in vraag worden gesteld door prehistorische onderzoekers. Ze zijn gebaseerd op de alomtegenwoordige en observeerbare verticale verspreiding van artefacten, vaak in niet-gestratificeerde sedimentaire contexten en omvatten verticale en laterale verplaatsingen die onder andere worden toegeschreven aan faunaturbatie, hellingserosie of hedendaagse landbouwpraktijken. Door artefacten aan elkaar te linken in ruimte en tijd, en op die manier een bijkomende observeerbare dataset te creëren, kan het refitten van lithische artefacten op verschillende niveaus een vooraanstaande onderzoeksbenadering vormen om deze hypotheses te bestuderen. Op basis van een uitgebreide inventaris van refit-studies van Belgische Mesolithische collecties, biedt dit artikel een overzicht van deze tot dusver eerder zeldzame 'tafonomische' refit-onderzoeken, inclusief een aantal tot dusver niet gepubliceerde refit-data van de vindplaats Doel – Deurganckdok sector J/L die onderwerp is geweest van één van de meest uitgebreide Mesolithische refit-studies uit deze regio. De focus ligt op de aard van de refit-bestanden en de manier waarop de argumentatie werd opgebouwd om vanuit de observaties uit het archeologisch bestand te komen tot uitspraken over het proces van post-depositionele verplaatsing van de artefacten. Uit dit overzicht blijkt dat voor de argumentaties, naast patinering en grondstofkenmerken, voornamelijk gebruik wordt gemaakt van (een combinatie) van het type, de lengte en oriëntatie van refit-lijnen, de fysieke linken tussen artefacten uit verschillende dieptes en de interne chronologie van afhakingen binnen het afhakingsproces. Tevens werd vastgesteld dat er nauwelijks wordt verwezen naar theoretische en conceptuele kaders en dat de refit-datasets waarop de beweringen zijn gestoeld vaak zeer beperkt van omvang zijn, met belangrijke gevolgen voor extrapolatie en representativiteit.

Trefwoorden: Mesolithicum, België, refitting, post-depositionele verplaatsing, formatieprocessen.

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