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Carabid beetles as ecological indicators in Belgian archaeology: the pioneering work of Konjev Desender

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Summary

An overview is given of the development of the analysis of archaeological carabid remains in Belgium, and of the crucial role played by Konjev Desender. The bibliography of the sites investigated over the last decennia is presented, and explanations are put forward for the rather biased nature of the dataset collected. An evaluation of the interpretive value of this research line indicates that the integration of the archaeological data into the recent biodiversity databases is a major step forward.

Key words: Carabidae, Belgium, archaeology, ecological reconstructions

Résumé

Cet article rend compte du développement de la recherche sur les restes archéologiques de coléoptères carabiques en Belgique et du rôle essentiel qu'a joué Konjev Desender dans ce processus. Une bibliographie des sites où les carabes ont été étudiés est établie et les raisons de la nature peu équilibrée du set de données sont expliqués. Après l'évaluation de la valeur interprétative de ces recherches il est clair que l'intégration des données archéologiques dans les bases de données de bio-diversité récentes est un grand pas en avant.

Mots-clefs: coléoptères carabiques, Belgique, archéologie, analyses environnementales

Introduction

Archaeology is the science that reconstructs, interprets and explains human behaviour in the past, through the analysis of excavated material remains. Originally, the conceptual framework was exclusively cultural, as if the development of the human species was only a matter of ideas, rituals, beliefs, politics, other social interactions, etc. However, with the rise of the 'New Archaeology', in the '60s of the 20th century, the idea became widely accepted that former human behaviour cannot be understood without taking into account interaction with the environment. In fact, it became clear that humans not only cannot exist or survive without exploiting other species (animal and plant resources) but also that much (most, even everything following the viewpoint of '*ecological determinism*') within human behaviour was and is influenced by the characteristics of the surrounding landscape, geology, soil, flora and fauna. Although the analysis of animal and plant remains as part of archaeological research is already an old phenomenon (see the contributions by botanists and zoologists, in the middle of the 19th century, to the excavations of Danish shellmiddens and the Swiss lakeside dwelling sites), the idea that the human species was part of a local, regional or global ecosystem, only gained considerable attention during the second half of the 20th century (see Trigger, 2006, for a history of archaeology).

This development invoked a stimulus for the analysis of non-cultural material derived from excavations. Gradually, more time and effort was invested into the sampling and recovery of organic finds present in the soil and deposits that constitute the '*archaeological record*'. This trend resulted in the growth of a specialist branch within archaeology, '*environmental archaeology*', concentrating on the interaction between humans, plants and animals in the past, through the study of former landscapes, (buried) soils, botanical and zoological remains (see Evans & O'Connor, 1999 for an introduction). The growing attention towards the recovery of organic remains during excavations led to the implementation of sieving techniques allowing adequate sampling of even the minutest biological remains. Within these finds collections, material from small animals was sometimes abundant and its presence could often not be explained by human consumption patterns, industrial or small scale use of animal products or other activities. Indeed, the extensive sieving campaigns showed that, in the past, a wide variety of smaller animals had ended up, without any direct human interference, in what are now archaeological contexts. Amongst the remains of these so-called 'intrusives', not only small rodents, insectivores, amphibians, reptiles or terrestrial molluscs are found, but also many species of insects and other arthropods.

Originally sometimes described as 'background fauna' (without too much importance for the study of former human behaviour), the intrusive animal remains are now widely used within archaeology as ecological indicators. Through an evaluation of the ecological characteristics of the intrusive species found, *i.e.* their habitat preferences (as known from the ecological studies of actual biotopes), inferences can be made about the former environment around the archaeological context investigated. The basic assumption taken when attempting such ecological reconstructions is that the 'principle of actuality' is valid (commonly used in palaeontology and stating that "the present is the key to the past"), implying that the ecological characteristics of a species should not have changed significantly through time. Given the evolutionary characteristics of insects, and the relatively short time lapse between the actual fauna and its archaeological predecessors (when evaluated on an evolutionary or geological scale), this assumption seems safe to accept (COOPE, 1978).

Animal remains are now frequently used in archaeological ecological reconstructions and interpretations. As indirect indicators of former vegetations, and biotopes in general, the species composition represented by the finds assemblages can be interpreted alongside more direct approaches within environmental archaeology, such as pollen analysis, the study of seeds and fruits, and charcoal identification. Experience revealed that carabid beetles (Carabidae) form one of the most powerful groups amongst the ecological indicators in archaeology. Over the last decades, fieldwork in Belgium has illustrated the validity of this statement (ERVYNCK *et al.*, 1996).

Carabid beetles in Belgian archaeology

Within Belgian archaeology, insects were used for the first time as ecological indicators in 1986, when remains from sieved samples collected at two archaeological sites were handed over to researchers at the Laboratory for Ecology of Ghent University (then directed by J. Hublé). Ironically, the results of one of these earliest studies, dealing with material from an Iron Age site at the 'Hogeweg' site, near Ghent (DESENDER, 1986e), are not yet published (unfortunately, considerable delays in the publication of excavation reports are a true characteristic of archaeology). Those from another site, a Roman fortification at Maldegem, did find their way into publication (MERTENS *et al.*, 1986) (see Fig. 1 for the location of all sites mentioned).

Taking into the account the development of the whole field of environmental archaeology in the country, with the first study of animal remains only being published in 1965 and sieving becoming common only since the 1980s, the late date of this innovation seems understandable (see www.onderzoeksbalans.be for a detailed description of the development of archaeology in Flanders). Even in the U.K., one of the pioneering countries for environmental archaeology, the first archaeological insect studies were only published in the second half of the 20th century (BUCKLAND, 1976).

Despite the enormous potential of archaeological entomology, the practicalities of archaeology (the constant lack of adequate funding, the need for expertise in many different fields) have hampered a full exploitation of this research line. In a discussion of the use of the remains of mites (Acarina) in archaeology, SCHELVIS (1993) once compared the relative abundance of animal groups within the living world against the research themes followed by archaeozoologists (Fig. 2) and concluded, quite ironically, that the most important groups in terms of taxonomic diversity and numerical abundance were least studied within archaeology. Of course, archaeology puts the human species in the centre of attention and animals that play(ed) a role in the food provisioning of people or in other human economical activities will therefore always receive disproportionally more attention. At the same time, however, it is clear that the information potential of many archaeological animal finds remains underexploited.

After the initial, exploratory, studies of archaeological insect remains, performed by multiple colleagues at the 'Laboratory of Ecology' at Ghent University (Konjev Desender, Luc Mercken, Johan Mertens, Marc Pollet and Mark Van Kerckvoorde), it was Konjev Desender who solely continued this line of research, also after moving from Ghent University to the Royal Belgian Institute of Natural Sciences. Over the years, a growing corpus of information was assembled, including material from prehistoric sites (Bronze Age Kontich: ANNAERT *et al.*, 2004, Iron Age Zele: DESENDER & ERVYNCK, 2004), Roman settlements (Braives: LENTACKER *et al.*, 1993, Bruyelle: PIGIÈRE *et al.*, 2001, 2002), Burst, Erpe-Mere: ERVYNCK *et al*,. 1987, 1991, Elewijt: VAN IMPE *et al.*, 2005, Erps-Kwerps: LENTACKER *et al.*, 1992, Liberchies: SCHELVIS *et al.*, 2001, Merelbeke: DE CLERCQ *et al.*,

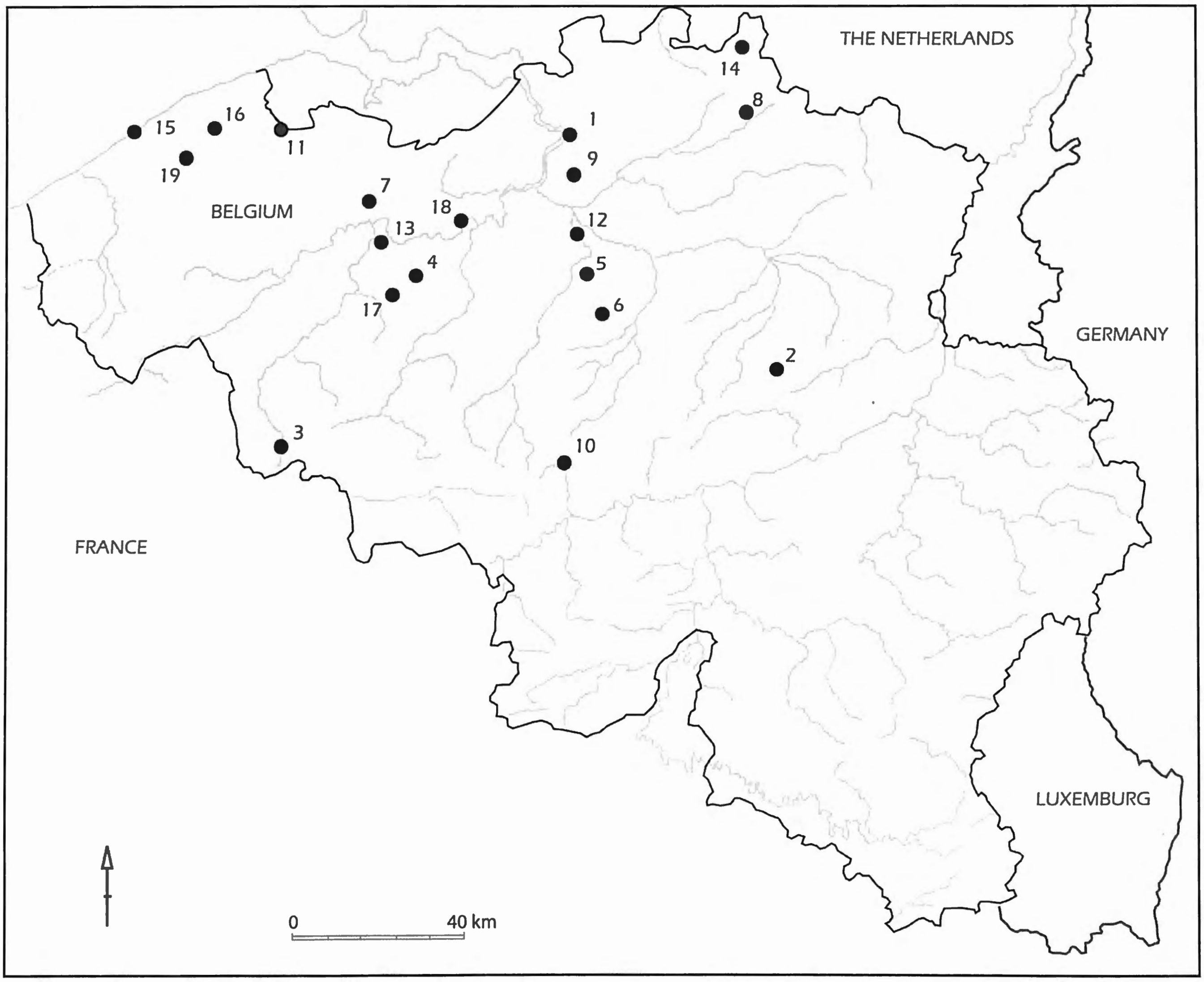

Fig. 1. – Location of the archaeological sites mentioned in the text (1: Antwerpen, 2: Braives, 3: Bruyelle, 4: Burst, 5: Elewijt, 6: Erps-Kwerps, 7: Hogeweg-Gent , 8: Kasterlee, 9: Kontich, 10: Liberchies, 11: Maldegem, 12: Mechelen, 13: Merelbeke, 14: Ravels, 15: Raversijde, 16: Sint-Andries, 17: Velzeke, 18: Zele, 19: Zerkegem).

2004, Ravels: VERHAERT *et al.*, 2004, Sint-Andries, Brugge: COOREMANS *et al.*, 2002, Velzeke: DESENDER & ERVYNCK, unpublished data) and medieval occupations (Antwerpen: BUNGENEERS *et al.*, 1989, Kasterlee: WOUTERS *et al.*, 1999, Raversijde: PIETERS *et al.*, 1999, Zerkegem: HOLLEVOET *et al.*, 1994). The last study undertaken by Konjev Desender dealt with a sample from the cesspit of the medieval prison of Malines (Mechelen: LENTACKER *et al.*, 2007).

The archaeo-entomological studies mentioned are characterised by a trend through time. Where the first studies attempted to incorporate a wide variety of taxonomic groups, soon the focus became concentrated upon carabid beetles (Carabidae). This choice was justified by comparing the characteristics of the carabids against those of other insect groups (ERVYNCK *et al.*, 1994, 1996). In order to be useful as ecological indicators within the archaeology of a certain region, an animal group should meet all of the following criteria: (1) its remains must have a good chance to become incorporated and survive in archaeological contexts, (2) the remains should not be extremely rare, (3) they must be identifiable to species level, (4) within the group, species variety must be high, (5) the ecology of the species involved must be sufficiently studied and understood, (6) at least some of the species involved must have a limited ecological tolerance, and (7) the taphonomic history of the finds must be understood and reliable. An evaluation of these criteria explains why, for example, butterflies (Lepidoptera) are not very

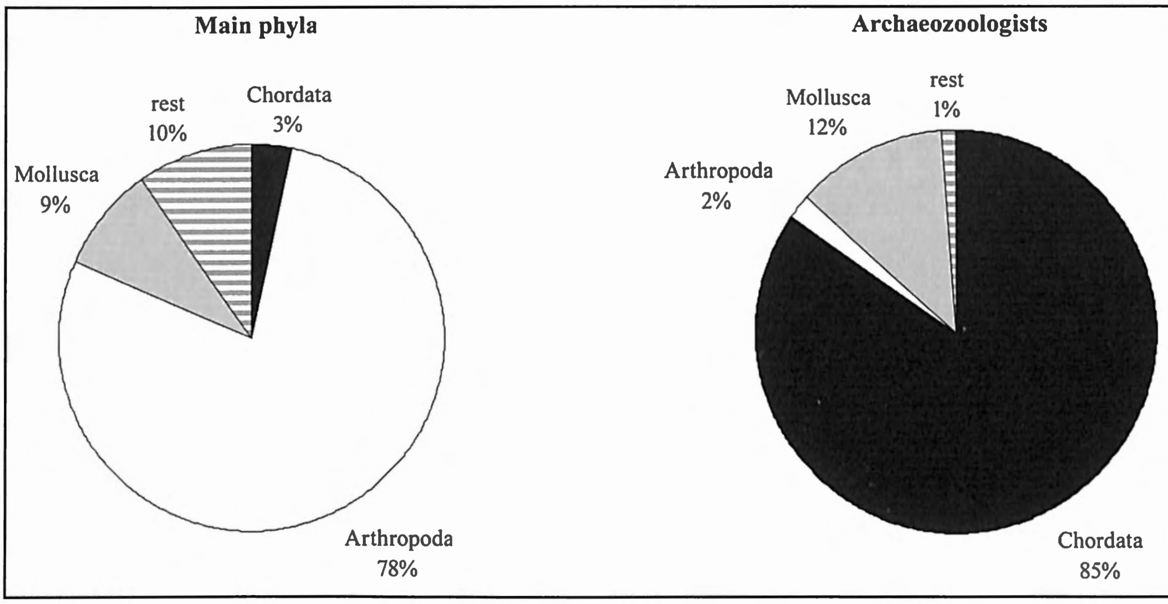

Fig. 2. – Discrepancy between the number of species within different animal groups and the number of archaeozoologists studying their remains (after SCHELVIS, 1993).

useful in archaeology (their remains typically do not preserve in the soil), why dung beetles (Scarabaeoidea) are not very reliable (these flying insects are attracted over wide distances to archaeological structures, such as wells, and thus often bear no relationship with the local biotope(s) one wants to reconstruct), or why flies (Diptera) are hardly ever used in archaeological ecological reconstructions (their archaeological remains, often wing fragments, offer very limited possibilities for identification).

In contrast, within the context of northwest-European archaeology, carabid beetles meet all of the criteria mentioned. The elements of their exoskeleton do survive in archaeological contexts and, when present, are often found in considerable numbers. Apparently, due to their walking instead of flying locomotion, they have always had a tendency to end up in an archaeological pitfall. For the specialist, with access to a good reference collection, identification of the head, thorax and elytra is often possible (Fig. 3). Moreover, species variety is rather high in the region considered and their ecology and distribution is well-studied (DESENDER, 1986a-d, DESENDER *et al.*, 2008). Of course, the interpretation potential of a number of eurytopic species, such as *Abax ater*, will always be limited compared to that of less tolerant species such as, for example, *Bembidion normannum*, which only occurs in salt marshes. In general, however, a sufficient number of carabid species in the northwest-European fauna shows clear ecological characteristics, making them good ecological indicators. Finally, the fact that most carabid species, even when winged forms are present in a population, do not travel large distances, implies that there is a causal relationship between their presence in an archaeological context and the environment around it.

Honesty necessitates underlining that, next to the ecological considerations mentioned, focusing on carabids amongst the insect remains within Belgian environmental archaeology was also a pragmatic choice. For some insect groups present in the sieved samples, specialists could (and can) simply not be found, or they show no interest in archaeological material. Secondly, concentrating on a single, well-studied group, proved to be most effective, considering the balance between time spent and results obtained. This approach, however, shows a stark contrast with the development of the field in other countries. In the Netherlands, for example, HAKBIJL (1989) explored the full taxonomic potential of no less than 27 families within the Coleoptera, in samples from an early Iron Age site in the Assendelver Polders. This tremendous effort, however, has never been repeated. Within the UK, again a wide variety of insect remains was studied, both within a paleontological approach (as part of the wider field of Quaternary palaeo-ecology, see ELIAS, 1994), or as a means to better understand the structure and functioning of archaeological sites. Within the latter approach, defining indicator groups for anthropogenic deposits or human activities is vital, regardless of the insect or arthropod group to which they taxonomically belong (see e.g. CARROTT & KENWARD, 2001, and the literature there). The latter approach, of high importance in archaeology, has never been followed in Belgium,

Fig. 3. – Remains of *Carabus granulatus* from a Roman well, excavated at Burst (see Fig. 1) (right), compared to a recent reference specimen (left) (photo by the author).

mostly because of the lack of suitable, well-preserved archaeological contexts, and samples from them.

Chronology and geographical distribution

Before attempting to evaluate the results of the archaeological analysis of carabid remains in Belgian archaeology, some comments must be made explaining the nature of the dataset available after more than 20 years of (occasional) research. Firstly, it is clear that the data are unevenly spread through time, with an apparent bias towards Roman sites, and that the northern part of the country is better represented than other regions. Without doubt, these patterns are the result of varying excavation intensity, in itself the result of the different human impact (building activity) upon the archaeological soil archives in different regions and upon different types of sites. Moreover, the time and effort spent on sieving sediment samples, determining the possibilities for the analysis of small animal remains, varies widely between archaeological working groups. These characteristics can explain, for example, why less carabid studies are available from Wallonia compared to Flanders.

Additionally, the nature of the archaeological record itself must also be considered. A recent survey of archaeology in Flanders (see www.onderzoeksbalans.be) shows that prehistoric sites, and certainly those with preserved organic remains, are relatively rare in the northern half of Belgium. The erosion of time certainly explains the absence of Stone Age carabid assemblages and the scarcity of material from the Metal (Bronze and Iron) Ages. However, this chronological loss of material and information does not help to understand the underrepresentation of material from the medieval and younger periods, versus that from Roman times. Possibly, the location of the sites investigated is partly responsible for this discrepancy. The Roman sites yielding carabid remains tend to be rural while the archaeology of the medieval and younger periods often concentrates on urban sites or large building complexes such as castles or abbeys. As carabids are less likely to occur in large numbers in these densely built-up areas, this could explain their relative scarcity in such sites. Indeed, the only medieval examples available derive from rural sites (Kasterlee: WOUTERS *et al.*, 1999, Raversijde: PIETERS *et al.*,1999, Zerkegem: HOLLEVOET *et al.*, 1994) or from an urban site that was an open terrain at the moment of the deposition of the carabid remains (Antwerpen: BUNGENEERS *et al.*, 1989). Within the sample from the cesspit of the medieval prison of Malines, only one carabid species was present (LENTACKER *et al.*, 2007).

On a smaller scale, preservation problems must be taken into account when evaluating different contexts within an archaeological site. While the skeletal elements of the carabids are mechanically strong, and chitin, the most important building material, is chemically resistant against varying pH levels in the soil, the water regime of an archaeological context is of more importance. An alternation of dry and humid conditions is detrimental while constantly moist or, even better, anoxic waterlogged conditions are ideal for their survival. Carabid beetle remains can also survive in constantly dry contexts (as in desert environments) but these tend not to occur in northwestern Europe. In general, the water regime explains why carabid remains are mostly found in waterlogged archaeological contexts (wells, ditches, etc.) in Belgium. That carabid remains are most often preserved in wells can also help to explain why Roman material is more abundant than medieval finds. Wells are indeed more commonly excavated at Roman rural sites than in younger, urban sites. Moreover, it could well be that Roman well construction was better suited to serve as traps for Carabidae. There are indications that Roman wells, in contrast to medieval examples, had no part above ground, making them more 'effective' as traps for passing animals.

Recently, archaeological fieldwork in a prehistoric occupation zone at Lommel-Maatheide (see GEERTS *et al.*, 2006) revealed that beetle remains, including carabids, were present in meaningful numbers in peat deposits located *off site*. However, due to the very compacted and sticky nature of the peat, the carabid remains could not be extracted. Different methods to do so have been attempted but manual recovery seems the only solution, a time consuming approach that has not yet been followed. Still, this observation highlights the potential of such non-anthropogenic deposits for the recovery of the Late Glacial and early Holocene material that is now missing in the dataset. Possibly, where such peat layers have survived into the historical period, even much younger material could be recovered, representing a natural, non-disturbed fauna that can be compared against the archaeological assemblages. In this way, archaeological carabid research in Belgium could finally make a link with the paleo-ecological work on Quaternary insects, which has received much attention in neighbouring countries (see ELIAS, 1994 for a review).

Archaeology and presentday ecology

When the results of the carabid samples from Belgian archaeological contexts (see the publications cited above) are put together, the ecological information gained, although of vital importance for the understanding of the sites, could be evaluated as being mostly of an anecdotal nature, and of little direct use for studies of present-day ecology. However, while it is true that each site report has to be seen as a single sample, and that much more data are needed, it has been possible to arrive at conclusions that have a more general application. This was possible by the incorporation of the ecological reconstructions within much broader frameworks of former human behaviour. The data for a Roman site at Merelbeke, for example, indicating the presence of fields in a landscape where on the basis of the soil characteristics only grasslands would be expected (DE CLERCQ *et al.*, 2004), fit into the general idea of a large-scale Roman agriculture characterised by the overexploitation of poor soils, exemplified by turning them from pastures into fields. All over the Low Countries, subsequent exhaustion of the soil, and erosion, soon ended these unfortunate agricultural projects (GROENMAN - VAN WAATERINGE,1983).

Interpretations become much more solid, of course, when a succession of faunas can be studied from a single structure. A rare opportunity for doing so was provided by the excavation of a Roman well at Burst, near Aalst. The fill of this structure showed that, at multiple occasions, sediment was deposited into the shaft and sorted into layers of sand, silt and clay (Fig. 4). This sedimentation process was interupted by three periods during which organic material could accumulate in the well. The carabid remains within these organic layers show the succession of a beetle fauna from grasslands, over a species composition typical for barren grounds (fields), to an assemblage reflecting a ruderal vegetation. The sequence again illustrates the phenomenon described earlier: Roman agricultural overexploitation, i.e. ploughing of grasslands to turn them into fields, causing soil destruction and rapid abandonment of the site (ERVYNCK *et al.*, 1987).

In general, the archaeological case studies show that the impact of people was already severe, centuries before the Industrial Era, quite certainly as early as Roman times. This was clearly the case for (local) deforestation, reflected by a general scarcity of stenotopic forest species amongst the carabids excavated. At the same time, however, it should not be concluded that untouched environments no

Fig. 4. – Stratigraphy of the fill of a Roman well, excavated at Burst (see Fig. 1) (photo M. Pieters, Flemish Heritage Institute).

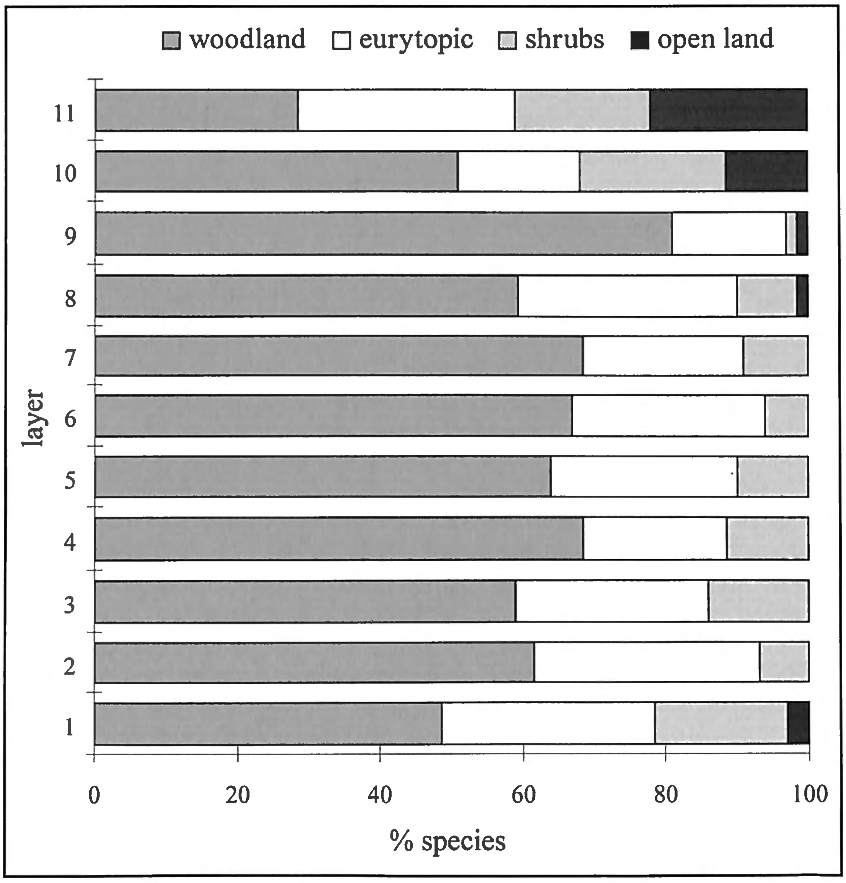

Fig. 5. – Sequence of the most important ecological groups of Carabidae in the fill of a Roman well at Velzeke (see Fig. 1) (Desender & Ervynck unpublished data).

longer occured in Roman times. This is, for example, illustrated by an unpublished sequence of material from a Roman well excavated near a temple site at Velzeke (near Zottegem) (Rogge, 1988), deposited from the late Roman to the early medieval period (dates on the basis of radiocarbon measurements) (Fig. 5). In the lowest part of the fill, a carabid fauna was found dominated by species of forest and shrubbery, with an admixture of species of open vegetation (cultural land). This suggests that the well was located in a forested environment, not an unusual situation for a temple site. Higher up in the sequence, the species of open vegetation disappear, without doubt reflecting the abandonment of the Roman site, after which forest regained the terrain. In the early medieval deposits, species indicating open vegetation reappear, the result of the wide-scale recolonisation of lands in that period (Desender & Ervynck, unpublished data). The changing frequency of forest species in the carabid sequence thus documents a broad demographic trend in the human population of Flanders, but proves, at the same time, that forest never disappeared completely during Roman times.

Within the development of the study of archaeological carabid remains, the case study from Velzeke has put an extra emphasis upon the fact that not only the cultural or historical interpretations are important but that the data are also relevant for the study of the present ecology of carabid faunas and the environments in which they occur. Indeed, the processes documented by environmental archaeology have defined the composition of the floras and faunas we find now, and this is particularly true for Carabidae. The poor mobility and colonisation capacity of most species within this group implies that (even short) changes in an environment provoke long-lasting alterations in the carabid species composition (see Desender & Vanden Bussche, 1998; Desender *et al.*, 1999). Consequently, from a time perspective, the actual carabid faunas provide an archive from which the impact of humans in an often-distant past can be inferred.

In general, the present state of the research into archaeological and actual carabid faunas seems to allow an integration of the datasets, stimulating a broader time perspective for ecological studies. The archaeological data make it clear that 19th century scientific information or old museum collections are not sufficient as references when reconstructing so-called 'original' faunas (not significantly influenced by human impact). The already mentioned Roman carabid collection from Velzeke contained a richer species spectrum of stenotopic forest dwellers than has ever been found in an actual forest environment in Belgium. This means that even the most 'natural looking' present-day forests have been heavily influenced by human activities and, in terms of carabid fauna, no longer represent an original situation (DESENDER *et al.*, 1999).

Inevitably, the integration of archaeological and actual data promoted a new methodological approach. Instead of comparing actual biotopes with the archaeological reconstructions of former environments (largely based upon a subjective evaluation of the presence, and sometimes abundance of species), a more integrated approach necessitated the incorporation of the basic archaeological identifications into databases of recent biodiversity surveys. Doing this, the archaeological assemblage is treated as any other sample and comparisons are made by statistical analyses (see DESENDER *et al.*, 1999 for forest species).

Future prospects

At the moment of the untimely death of Konjev Desender, archaeological carabid research in Belgium had a bright future, certainly also through the integration into actual ecological research frameworks. Moreover, the integrated approach made it easier to present the research results to a wider public (see e.g. DESENDER 2009, published posthumously). As the years of data collecting are now beginning to produce higher interpretation levels, Konjev's research must certainly be continued. New specialists will have to be convinced to work with archaeological material and, in a changing world in which archaeology becomes more and more commercialised, means will have to be sought to allow this to happen. Otherwise, archaeological carabid research in Belgium will only have known a promising start...

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