1 Introduction

The present research started when the author wrote a master's thesis about the wear analysis of the Bronze Age flint assemblage from Oldeboorn, Friesland (Van Gijn 1983). Subsequently, a project of the Netherlands Organization for Scientific Research (NWO) was initiated in 1984 under supervision of Prof.Dr. L.P. Louwe Kooijmans. The primary objective of this project was to assess the possibilities of microwear analysis for Dutch flint assemblages. Archaeological investigations included those pertaining to form and function (i.e. would it be possible to predict function on the basis of certain morphological characteristics?) and a study of the economic activities carried out at the various sites. Technical objectives encompassed research into the quantification of wear-traces and into the process of patination. Lastly, a reference collection of experimentally-used flint tools was to be started, with special emphasis on those dealing with the processing of fish. This latter material had been underemphasized in previous research-projects and was considered especially important in Dutch (coastal) contexts.

When the above research project was proposed, microwear analysis in the Netherlands was not yet well-established, and there was much scepticism about the results which could be obtained, especially regarding Palaeolithic assemblages. For this reason a diachronic perspective was opted for, and sites were chosen from various periods. The Middle Palaeolithic sites of Belvédère, the Upper Palaeolithic sites of Emmerhout, Diever and Rolde, the Linearbandkeramik (LBK) site of Beek-Molensteeg, and the Late Neolithic sites of Hekelingen III and Molenaarsgraaf were initially selected. In addition, the possibility was left open to include other relevant material as well.

These assemblages have in common that they are (or were believed to be, cf. *chapter 5*) relatively small, reflecting short-term occupations, and are all well-excavated (i.e. the provenance of the artefacts is known). Moreover, in several cases, such as at Hekelingen III, ecological information was available to indicate the sort of experiments needed as a reference. Lastly, the above-mentioned sites did not only vary in age, but also with respect to the matrix in which the artefacts were embedded; it was thought that this aspect too might be influencing the preservation of the use-wear traces.

In the course of the research, however, the 'test-case' character of the initial proposal turned out to be rather dissatisfying, especially due to the consequent lack of interesting archaeological (cultural) problems to confront. The various sites studied were so individual in character that there was little possibility of comparing them. The fact that the author became a member of the academic staff at the Institute of Prehistory in Leiden (IPL) made it possible to change the content of the research to some extent. It was decided to focus on Neolithic assemblages because of the author's primary interest in this period. Most microwear research had so far been concentrated on Middle and Upper Palaeolithic assemblages and it was considered interesting to meet the challenge of investigating the 'Neolithic novelties' (Keeley 1983). Of particular interest was the apparent continuation, far into the Neolithic, of hunter-gathering-fishing subsistence strategies contemporaneous with farming. As such it was possible to explore the potential of microwear analysis as a means of answering questions regarding functional differentiation of settlements. Only by addressing such current archaeological issues, is it possible to demonstrate the relevance of going through the trouble, both in terms of time and costs, of doing a use-wear analysis.

This change of research objectives had the following consequences for the composition of the samples studied. As Hekelingen III had been the first assemblage examined (1984-1985), and had yielded interesting results, it was retained. In addition, to examine site variation within one cultural group (the Vlaardingen culture, or Vlaardingen-group as suggested by Louwe Kooijmans (1983a)), Leidschendam was selected as a comparison. Molenaarsgraaf was rejected for analysis because of extensive abrasion of the artefacts (possibly due to the sandy matrix). Other Late Neolithic assemblages were also checked, such as Ewijk and Voorschoten (both Vlaardingen-group), and Kolhorn (Protruding Foot Beaker Culture), but these displayed the same problem as the one of Molenaarsgraaf. Of the initial sample, Beek-Molensteeg also remained, because it was believed to be a small site; as all other known Linearbandkeramik (LBK) settlements of the Graetheide Plateau are large, it was thought that Beek-Molensteeg might possibly be an example of a site with a different function. Unfortunately, it soon became apparent that the site only formed a small section of a much larger ('normal') LBK settlement.

Parts of the initial NWO research proposal are not pre-

sented in this study, but were nevertheless realized and published elsewhere. A detailed analysis was done, involving study by scanning electron microscope (SEM) and energy dispersion analysis (EDAX), of experimental fish-processing implements (Van Gijn 1986a). To investigate the limitations of microwear analysis as a method, an international blind test was organized, in which the author participated (Unrath et al. 1986). Samples of several sites within the Belvédère gravel quarry, such as C, F, and G, were studied (Roebroeks et al. 1986; Van Gijn 1989), while others are still being examined (site J and K). Lastly, a study was made of a typical form-function problem within Dutch archaeology, that of the Late Bronze Age sickles (Van Gijn 1988, *in press b*). The only aspect of the original NWO proposal which has not been realized, forms the analysis of the Upper Palaeolithic assemblages of Emmerhout, Diever and Rolde.

It must be stressed that the present study was done over several years (1984-1989), during which microwear analysis as a method was going through a number of phases (see *chapter 7*). The research presented here was formulated and initiated during the end of the first, very optimistic period, in which microwear analysis was introduced. The large bulk of the analyses was done in the second, 'introspective, self-critical' (Juel Jensen 1988a: 59) phase, during which a number of critical articles appeared, and scepticism and disappointment prevailed. At present, the method is gradually moving into phase three, characterized by a more well-balanced use with an awareness of the possibilities and limitations; the study was finished during this period.

For this reason the work is also a reflection of the changing attitudes of the author towards use-wear analysis in general, and microwear analysis in particular. As such it is, in a sense, somewhat unbalanced at times. Major reason for this unbalance is that, at the outset of this study, it was still generally assumed that we could identify polishes and other wear-traces, thereby arriving at a relatively secure determination of tool function. However, it was soon evident that so many problems prevailed (cf. *chapter 2*), that it was more appropriate to speak of an interpretation of wear-traces. Through time it also became clear that not all of the objectives initially formulated were feasible, while others were outdated, or considered less interesting. For example, research into possible ways of quantifying the texture or reflectivity of polishes is deemed to be fruitless, until the nature of polishes is better understood. This latter subject is clearly beyond the competence of archaeologists and it is to be hoped that some relevant research by surface chemists and physicists will filter through to archaeology. Instead, it was decided to attempt to count (on experimentally used tools with a known function) the occurrence of those attributes easily observable in daily microwear practice. In this manner the inferential limitations of the method can be explored: how high a percentage of each contact substance can we potentially trace in the archaeological record? Yet another, technical, objective of the initial NWO proposal was modified. Instead of randomly performing experiments towards illuminating the character of post-depositional surface modifications, a survey of previously studied archaeological assemblages was done, in order to look for clues as to what factors might possibly be relevant. As to the archaeological objectives, the emphasis was shifted from form-function questions towards those pertaining to settlement function and differentiation (see above). Nevertheless, aspects of morphology and their relationship to tool function were addressed, because the results may provide a clue as to how to sample assemblages more efficiently.

These considerations led to the following framework. The volume begins with an overview of methods and techniques, in which the approach used will be presented in the light of some current debates about the validity of microwear analysis (*chapter 2*). Next, the experimental program is discussed, as well as the quantification of relevant wear-attributes visible on the experimental tools; such a quantification makes it possible to evaluate the representativity of the results obtained for an archaeological assemblage (*chapter 3*). In chapter 4 an overview is given of post-depositional surface modifications (pdsm) present on flint artefacts and the way wear-traces are affected by them. By examining the results obtained from assemblages studied in the past (in terms of frequency of pdsm, matrix from which the implements derive, and age and type of settlement), an attempt is made to isolate relevant factors responsible for the destruction of wear-traces. Chapter 5 deals with the flint assemblage from the LBK site of Beek-Molensteeg; both a description of the technological features, and an analysis of the wear-traces found is provided. The two Vlaardingen sites, Hekelingen III and Leidschendam, are presented in chapter 6. The main objective was to try to unravel their respective functions in the settlement system. In chapter 7 the suitability of microwear analysis for the solution of general archaeological problems is discussed.