

Correspondence

Problems of lithostratigraphic classification of Holocene deposits in the perimarine area of the Netherlands

*Comment**

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Berendsen (1984) revised the stratigraphic nomenclature for the Holocene deposits of the so-called perimarine area of the Netherlands. He rightly pointed out that lithostratigraphic, chronostratigraphic, and genetic concepts were not clearly distinguished in previous work. This mixing of concepts, has not surprisingly so, resulted in some confusion about the use of various stratigraphic names.

From Berendsen's paper and Verbraeck's (1970) detailed map of part of the perimarine area, it is clear that depositional landforms also play a significant role in the recognition and mapping of various Holocene deposits. Examples of units that are mapped at least in part on the basis of geomorphological criteria, are the 'Young dune sand', and 'Old dune sand' of the Westland Formation, the 'Channel and bank deposits', and 'Flood-basin deposits' of the Betuwe Formation (cf. Berendsen 1984, Fig. 2).

Implicitly using the geomorphological expression 'Flood-basin deposits' as a mapping criterion, means of course that 'Betuwe Formation' is not a lithostratigraphic unit at all. Nor for that matter are some of the other mappable units. Nevertheless it is obvious that the Netherlands have been mapped in a meaningful, understandable manner (e.g. Zagwijn & Van Staaldin 1975), and that these maps form a fair basis for understanding Quaternary history. In other words the problem addressed by Berendsen (1984) is largely a semantic one about the classification and naming of mappable units.

Fortunately a solution to this semantic problem is available in the proposal by Frye & Willmann (1962) to map 'morphostratigraphic' units rather than lithostratigraphic ones. Their proposal was based on mapping practices for the Quaternary of Illinois. Frye & Willman (1962) explicitly used depositional landforms to map Pleistocene moraines. They emphasized that the same approach can be used for the mapping and classification of for instance beach ridges, alluvial fans, alluvial terrace deposits, etc.

The definition of a morphostratigraphic unit proposed by Frye & Willman is as follows: 'A morphostratigraphic unit is defined primarily from the surface form it displays; it may or may not be distinctive lithologically from contiguous units; it may or may not transgress time throughout its extent'.

Both in reconnaissance and detailed geological mapping the concept of morphostratigraphic units is very useful. In regional reconnaissance mapping, where one relies largely on photo interpretation, it is probably the only way of meaningfully mapping Quaternary deposits (cf. Jackson & Van de Graaff 1981). The main reason for its usefulness is that it makes explicit the criteria used for mapping. It thus avoids arguments over the distinction of map units on the basis of minor, or even non-existing, lithological differences.

Hedberg (1976) in his discussion of categories of stratigraphic classification (p. 8-9) clearly left open the possibility of using units which are not based on

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lithological, biostratigraphical, or chronostratigraphical characteristics. He stated: 'No one can, nor need, use all possible kinds of stratigraphic units, but the way should be open to use any that promise to be useful; and it should be clear from the unit terms to which category of classification any named unit belongs'.

Frye & Willman's (1962) proposal was effectively adopted in the 1983 version of the North American Stratigraphic Code. In that Code the term 'Allostratigraphic Units' (Articles 58-60), covers the types of units Frye & Willman so aptly called 'morphostratigraphic units'.

Reply

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Lithostratigraphic classification by international agreement, should be based on lithologic criteria (Hedberg 1976). In fact, Van de Graaff's comment rather effectively underlines my viewpoint that the so-called lithostratigraphic subdivision of the Westland Formation into *members* like 'Young Dune sand', 'Old Dune Sand', 'Calais deposits' etc. is untenable, because morphological or chronostratigraphical criteria are used in this case.

Van de Graaff rightly points out that other types of classification (e.g. morphostratigraphic classification) may be used when necessary. There is no objection against morphostratigraphic, as long as it is used as a separate category of classification, and unit terms are not mixed or confused with lithostratigraphic unit terms.

Still, some warning against morphostratigraphy is appropriate: the pitfalls of Pleistocene morphostratigraphic in the Alps are still impeding stratigraphic work all over the world (cf. Bowen 1978). Unfortunately, the discussion about morphostratigraphic largely misses the point, because in the Westland Formation considerable confusion and mixing of unit-terms has taken place. To qualify this as a semantic problem is a gross misunderstanding of the nature of the whole matter. The genetic

model of the Westland Formation has grown into a self-fulfilling prophecy that can only be tackled with adequate stratigraphic research, and appropriate stratigraphic nomenclature.

Stating clearly the actual criteria used for mapping of Holocene deposits should help reduce the number of disagreements between students of these sediments. This in turn should help to concentrate on more important aspects than stratigraphic nomenclature as such. For instance it would allow more attention to properly document proposed new units by at least specifying a type locality in the first generally available publication (Broek Formation, Berendsen 1984).

The Betuwe Formation is an entirely different case. As a whole, it certainly can be defined as a lithostratigraphic unit, but it has never been subdivided into *members* (i.e. lithostratigraphic units of lower rank), as is the case with the Westland Formation.

Instead, the Betuwe Formation for practical (mapping) purposes is subdivided into genetic units (e.g. 'channel deposits', and 'flood-basin deposits') that have certain lithological characteristics, but that have never been described as members in a lithostratigraphical sense. This is exactly the kind of procedure Hedberg (1976, p. 8-9) refers to: the units are meaningful and useful in mapping, and it is clear that they are not meant to be lithostratigraphic units. There is no objection whatsoever against it.

Stratigraphic names are not so important, but stratigraphic nomenclature is, because different unit terms are needed for each category of stratigraphic classification (cf. Hedberg 1976, p. 9). Finally, I should like to stress, that for a properly

documented description (including a type locality) of the Broek Formation reference should be made to Berendsen (1982), not to Berendsen (1984), since the introduction took place simultaneously in a thesis and a scientific journal, which is generally and widely available on request, by purchase or through a library.

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