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CONTRIBUTION TO THE STRATIGRAPHY OF THE WEICHSEL PLENIGLACIAL IN THE BELGIAN COVERSAND AREA

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ABSTRACT

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Earlier stratigraphical studies of the Upper Quaternary in N.W. Belgium have been supplemented with some recently obtained dates, which allowed to make a new approach to construct a more detailed stratigraphical table of the Weichsel Pleniglacial in this region.

Between a series of "laminated sands and silts" (undermost part) and a series of "coversands" (uppermost part) an important peat bed was found (Assebroek peat). The pollen spectrum indicates relative warm conditions. A ^{14}C-date of 30,700 BP was obtained and therefore the peat is correlated with the Arcy-Kesselt interstadial. The overlying "coversands" are characterized by three levels of ice wedges and frost cracks and by one pebble string. The formation of the lowermost level of large deep ice wedges is dated between 26,220 BP and 24,760 BP.

It is shown that the severest climatic conditions during the Weichselian started very soon after the Arcy-Kesselt interstadial.

INTRODUCTION

The study of several excavations in the neighbourhood of Brugge (NW-Belgium) allowed a stratigraphical scheme of the Young Pleistocene in this region to be constructed (Vandenberghe *et al.*, 1974). At the same time also the stratigraphy of the Zuiderkempen (Central Belgium) was studied in borings and excavations (Vandenberghe, 1973). In both regions (fig. 1) the sediments from this period consist mainly of coversands and loams. The stratigraphical conclusions are supported by a complete study of the sediments (structure, grain-size analyses, mineralogy, etc.) and by the analysis of pollen and fauna. Once the results of some absolute radiocarbon dates were obtained, a new approach was made to correlate the stratigraphy of both regions and also to compare them with surrounding regions.

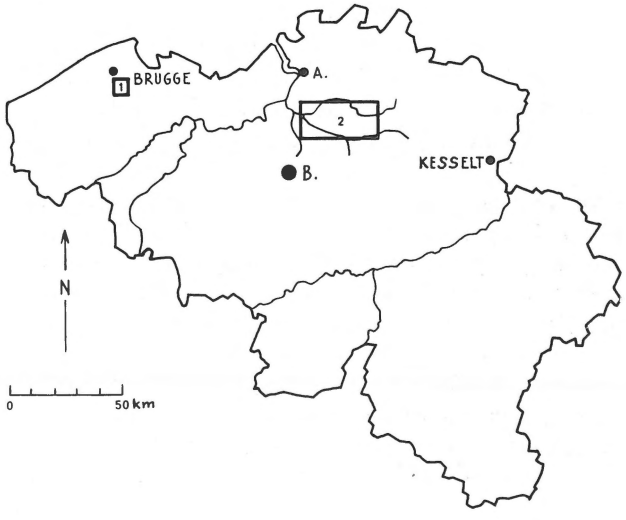

Fig. 1
Situation of the studied regions (1: Brugge, 2: Zuiderkempen).

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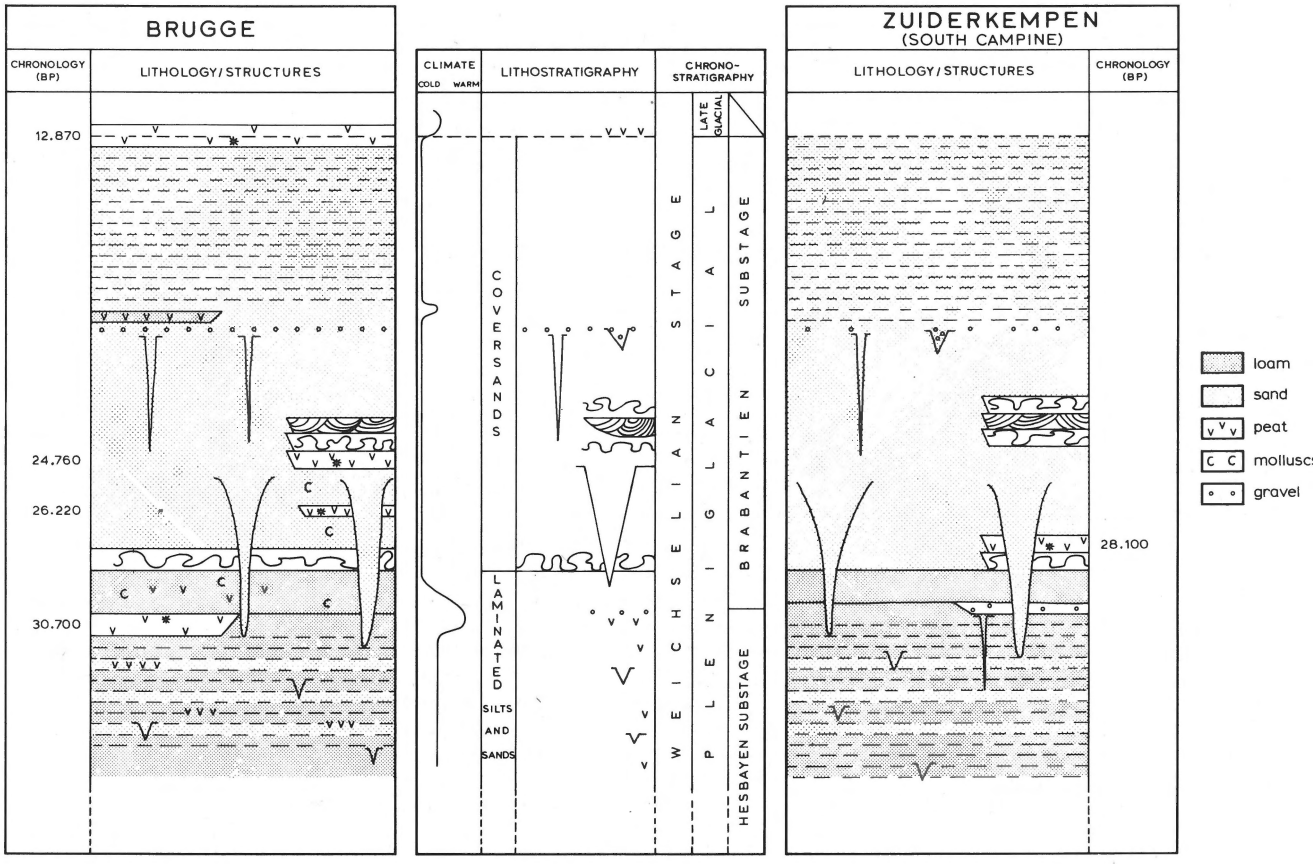


Fig. 2
Weichselian litho- and chronostratigraphical sequences.

STRATIGRAPHY OF THE TWO SITES

In Brugge the sedimentary series is underlain by an Eemian schorre clay while at the top a Holocene peat occurs. The Weichselian sedimentary series could always be divided into two distinct lithostratigraphical units. In the lowermost part a clearly stratified alternation of silty (sometimes peaty) and sandy laminae occurs. The uppermost part, however, is more homogeneous and less silty. This twofold division of the Weichsel Pleniglacial was already stated by Gullentops (1954). Results are summarised in fig. 2.

The "laminated sands and silts" (lowermost part) in these regions provide few data towards a further refinement of the stratigraphy. Pollenanalyses (30% tree pollen, rare thermofilous elements) and the occurrence of small dispersed frost cracks point to a subarctic to cold temperate climate. The regular lamination is a characteristic feature of intense sheetwash and also an indication of humid conditions. Identical sediments were described as "peaty loam formations" by Paepe & van Hoorne (1967) and as "loamy beds and peat" by van der Hammen *et al.* (1967). At the top of this series a compact loam layer was deposited.

At the base of this loam layer an important peat bed was found in Brugge (Assebroek peat). In the pollen spectrum *Alnus* dominates and some thermofilous trees occur in small quantities (fig. 3). This points to climatic conditions which were warmer than those during the oscillations in the late glacial. We can thus assume that the peat was formed during a temperate climate. The stratigraphical position of the Assebroek peat already indicated that it was situated in the middle of the Pleniglacial. A confirmation was then obtained by the ^{14}C-date of 30,700 BP ± 350 (Gr N-7097). This peat can thus most probably be correlated with the Arcy-Kesselt interstadial (Gullentops, 1954; Bastin, 1970). The vegetation pattern is less in agreement with the pollen diagrams of about the same age in The Netherlands (Denekamp interstadial), e.g. in the Dinkel Valley (van der Hammen & Wijmstra, 1971) but corresponds more with pollen diagrams from the cover loam area, e.g. at Kesselt (Bastin, 1970)

The loam layer overlying the Assebroek peat is heavily cryoturbated (fig. 4) and in the Zuiderkempen even a typical 'Brödelboden' was observed. Later the laminated silts and sands were replaced by more homogeneous silty "coversands" (uppermost part), interrupted by short periods of peat growth. In this "coversands" series three levels of frost wedges

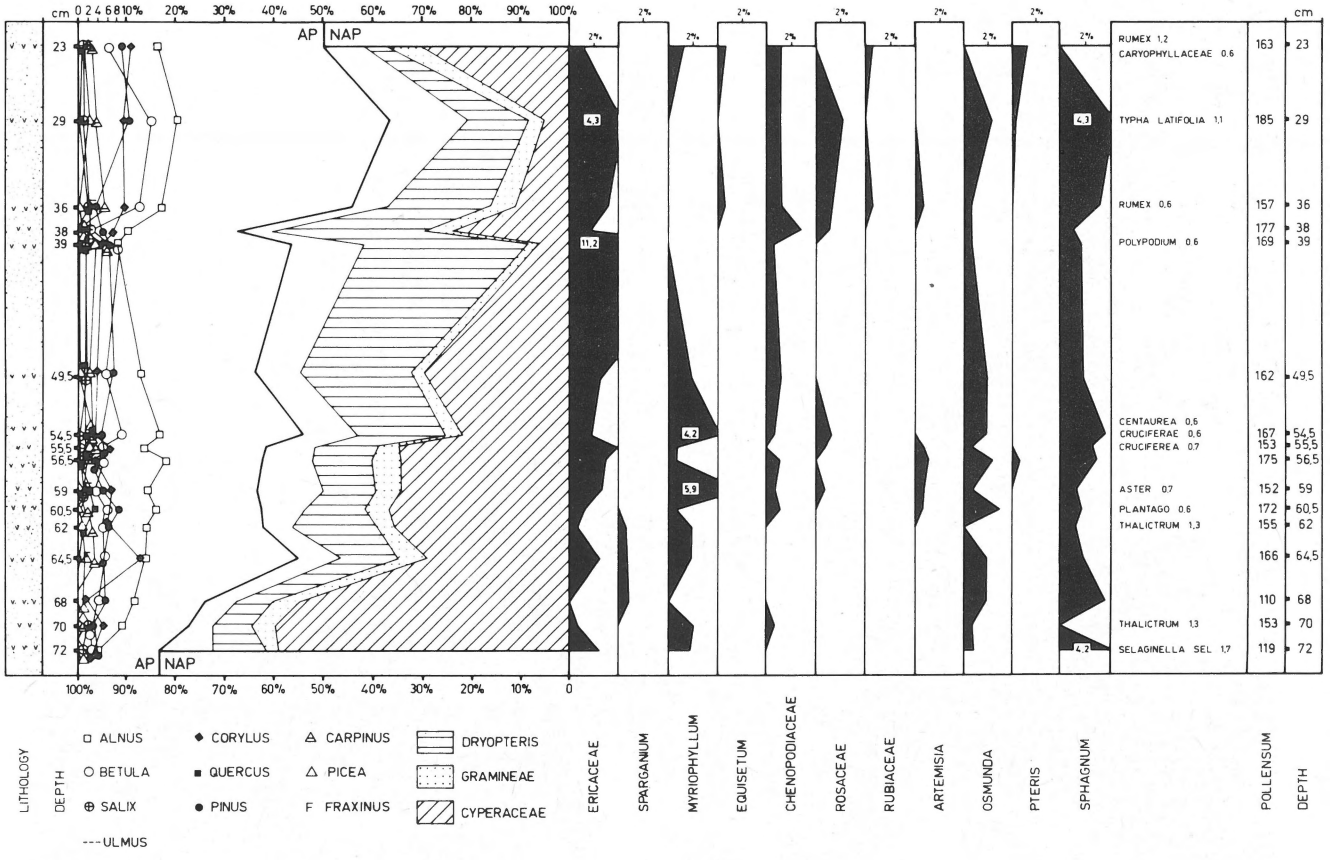


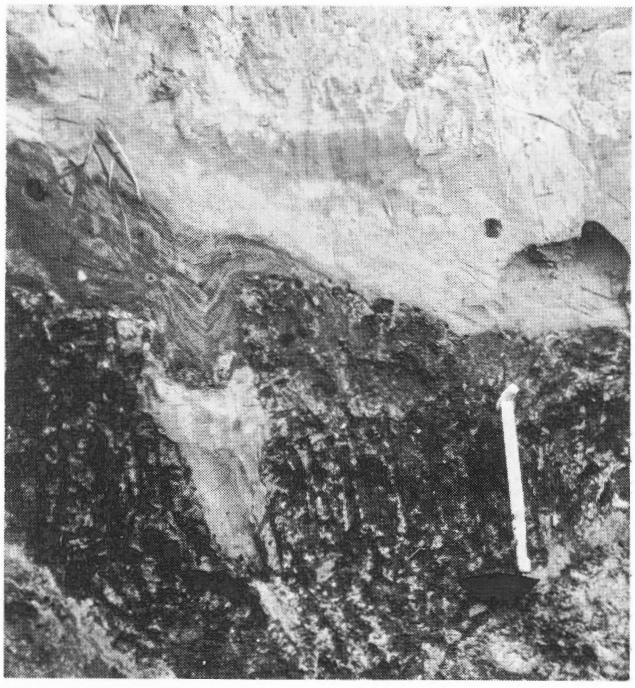
Fig. 3
Pollen diagram of the peat at the bottom of the uppermost loam player at Brugge (V a n d e n b e r g h e *et al.*, 1974) – radiocarbon dating: 30,700 BP ± 350 (Gr N-7097).

could be observed: the large, deep and syngenetic ice wedges are the oldest (fig. 5), followed by fine deep frost fissures and finally shallow broad ice wedges. It is remarkable that these three levels occur in all excavations at the same stratigraphical position. Two cryoturbation levels occur locally between the two lowermost levels. The occurrence of large ice wedges in the upper part of the coversands was already found by d e P l o e y (1961) in the 'Noorderkempen' (Northern Belgium).

Another characteristic phenomenon is a generally occurring pebble layer, situated at the level of the youngest frost wedges and just above the fine deep frost cracks. This pebble line also subdivides the "coversands" series again into to parts (fig. 2). In the basal still loamy "coversands" sheetwash features or gully structures (fig. 5) were found locally. In the homogeneous finely layered sands above the pebble line the silt content is low and fluvial structures no longer occur. These "coversands" are known as "older coversands" in The Netherlands and are called the 'Lutterzand Member' by v a n d e r H a m m e n *et al.*, 1967. These authors as well as P a e p e & v a n H o o r n e (1967) subdivided the 'coversands' series into two parts (coversands 1 and 2) separated by a pebble layer (Beuningen gravel, "pebble layer 3"). So, there is a good chance that this pebble layer can be correlated with the "pebble layer 3" and the Beuningen gravel (Z a g w i j n & P a e p e, 1968).

All pollen analyses in the "coversands" series point to a very severe cold climate (< 10% tree pollen, starting with an intense cryoturbation just after the deposition of the "laminated sands and silts". The climate was also very dry especially in the last period (after the formation of the pebble layer). We have obtained three ^{14}C-datesfrom three successive peat layers at the base of the "coversands": 28,100 BP ± 300 (Gr N-7098), 26,220 BP ± 900) (Lv-685) and 24,760 BP ± 590 (Lv-684). Pollen diagrams of these three peat layers are represented in figs. 6-7-8. The formation of the large deep ice wedges took place between the last two dates (fig. 2). The composition of the molluscan fauna in the basal part is characteristic of a periodically humid tundra. The pebble layer is locally overlain by a very fine, peaty silt (Katelijne peat). The pollen spectrum is composed of 50%

Fig. 4
Cryoturbated structures in the uppermost loam layer of the "laminated sands and silts"



tree pollen and *Pinus* is dominant. It is the only place in the "coversands" series suggesting less severe conditions. Correlation with one of the warm oscillations at the end of the Weichsel Pleniglacial is not yet possible. Indeed, we must wait for a better developed horizon to be found in order to execute further radiocarbon dating.

CONCLUSIONS

It is clear that both coversand regions show a very similar stratigraphy during the Weichsel Pleniglacial. An important fact is the absolute dating of the interstadial in the middle of the Weichsel Pleniglacial which can almost certainly be correlated with the Kesselt-interstadial in the loess stratigraphy (G u l l e n t o p s, 1954). Further, it is remarkable that in these regions the most severe climatic conditions of the Pleniglacial started immediately after this interstadial (less than ± 2600 years), resulting in the formation of a "Brödel-

Fig. 5
Large ice wedge piercing through Tertiary clay. Gully deposits are slightly sunk down in the ice wedge.

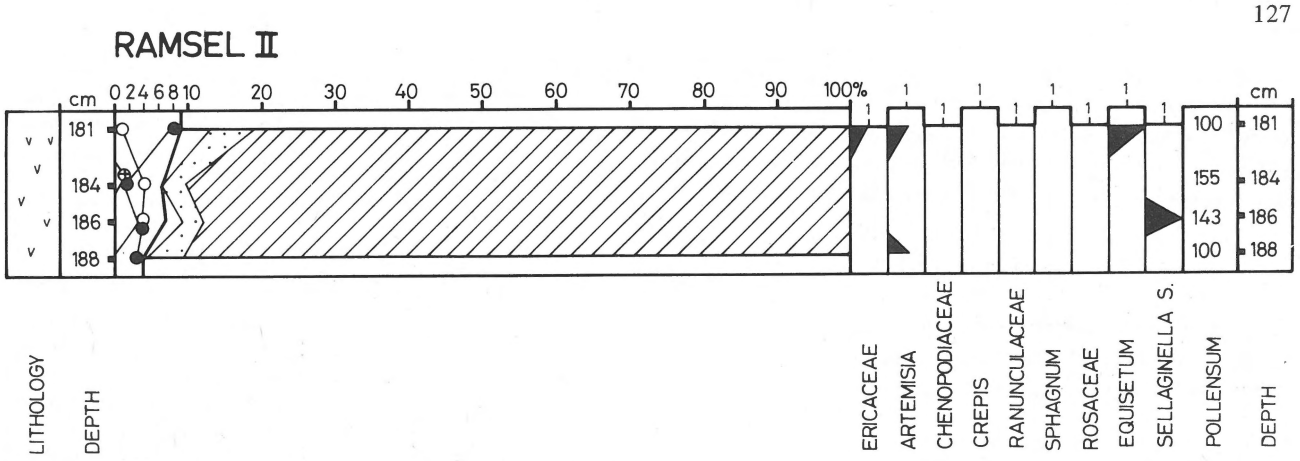


Fig. 6
Pollen diagram from a peat at the base of the "coversands" at Ramsel (Zuiderkempen). (Vandenberghe, 1973) – radiocarbon dating: 28,100 BP ± 300 (Gr N-7098).

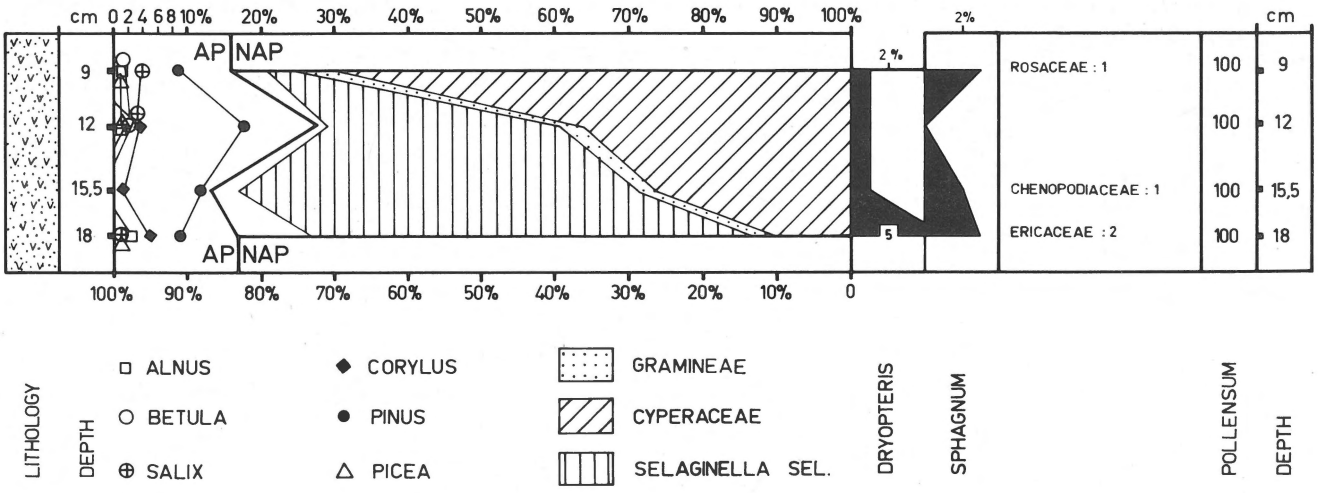


Fig. 7
Pollen diagram of a peat layer underlying the large deep ice wedges at Vijve-Kapelle (Brugge) (V a n d e n b e r g h e *et al.*, 1974) – radiocabron dating: 26,220 BP ± 900 (Lv-685).

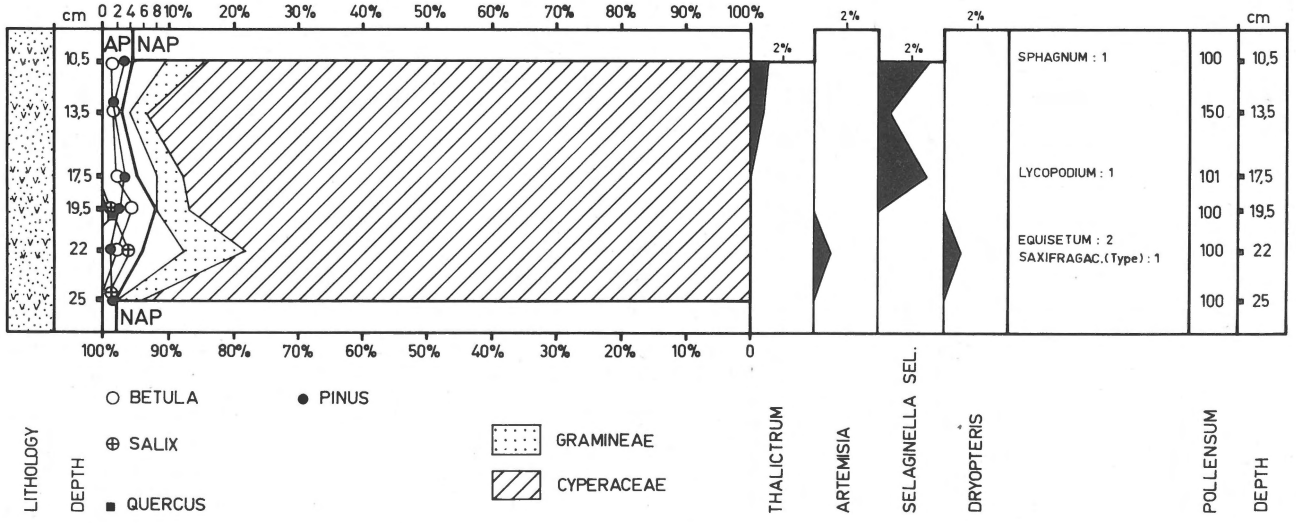


Fig. 8
Pollen diagram of a peat layer overlying the large deep ice wedges at Vijve-Kapelle (Brugge) (V a n d e n b e r g h e *et al.*, 1974) – radiocarbon dating: 24,760 BP ± 590 (Lv-684).

boden", ice wedges, cryoturbations, deflation horizons, etc. and continuing to the beginning of the late glacial. It was shown that the frost crack levels occur in the same lithostratigraphical position in both regions. Finally it was possible to date precisely the formation of the large deep ice wedges.

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REFERENCES

Bastin, B. (1970) – La chronostratigraphie du Würm en Belgique, à la lumière de la palynologie des loess et limons. Ann. Soc. Géol. Belg., 93, p. 545-580.

Gullentops, F. (1954) – Contribution à la chronologie du Pleistocène et des formes du relief en Belgique. Mém. Inst.Géol. Univ. Louvain, 18, p. 123-252.

Hammen, T. van der, G.C. Maarleveld, S.C. Vogel & W.H. Zagwijn (1967) – Stratigraphy, climatic succession and radiocarbon dating of the last glacial in The Netherlands. Geol. Mijnbouw, 46, p. 79-95.

Hammen, T. van der & T.A. Wijmstra (1971) – The Upper Quaternary of the Dinkel valley. Meded. Rijks Geol. Dienst, N.S. 22, p. 55-214.

Leroi-Gourhan, A. (1964) – Chronologie des grottes d'Arcy-sur-Cure (Yonne), I. Climats du Quaternaire récent. Gallia-Préhistoire, 7, p. 1-35.

Paepe, R. & R. van Hoorne (1967) – The stratigraphy and paleobotany of the Late Pleistocene in Belgium. Toelicht. Verh. Geol. Kaart en Mijnkaart van België, 8, 95 pp.

Ploey, J. de (1961) – Morfologie en kwartairstratigrafie van de Antwerpse Noorderkempen. Acta Geogr. Lovan., I, 130 pp.

Vandenberghe, J. (1973) – Geomorfologie der Zuiderkempen. Doct. thesis, Kath. Univ. Leuven, 210 + 202 pp.

Vandenberghe, J., N. Vandenberghe & F. Gullentops (1974) – Late Pleistocene and Holocene in the neighbourhood of Brugge. Meded. Kon. Acad. Wetensch., Lett. Schone Kunsten België, Kl. Wetensch., 36, 77 pp.

Zagwijn, W.H. & R. Paepe (1968) – Die Stratigraphie der weichselzeitlichen Ablagerungen der Niederlände und Belgiens. Eiszeitalter Gegenwart, 19, p. 129-146.