Studia Quaternaria, vol. 22: 55–57.

Daphnia REMAINS FROM THE SEDIMENT OF LAKE SOMASLAMPI (NW FINNISH LAPLAND) AND LAKE WIGRY (NE POLAND)

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Abstract

In this paper remains of *Daphnia* found in the sediments retrieved from Lake Somaslampi (NW Finnish Lapland) and Lake Wigry (NE Poland) are presented and compared with *Daphnia* remains found by D.G. Frey in Greenland. *Daphnia pulex* haedshields and shells were found in the early Holocene sediments of Lake Somaslampi. In the early Holocene sediments of Lake Wigry only postabdominal claws and ephippia of *Daphnia* were abundant, but in the sediments deposited during the last 50 years very well preserved shells of *Daphnia longispina*-group were found. The present findings indicate that the good preservation of *Daphnia* haedshields and shells may be more common than previously thought. It is possible that the special conditions they need to be preserved is cold climate.

Key words: subfossil *Daphnia* sp., lacustrine sediment, NW Finnish Lapland, NE Poland

INTRODUCTION

The family Daphnidae which is important in limnological investigations, is represented by abundant species in fresh water zooplankton (Flössner 1993, Brancelj *et al.* 1996), but is rarely investigated in paleolimnological studies. Usually, in lacustrine sediments only fragments of *Daphnia* such as postabdominal claws, ephippia and sometimes spines are well preserved (Brancelj *et al.* 2002, Bredesen *et al.* 2002, Hofmann 2003, Korhola 1999, Sarmaja-Korjonen 2002, Schmidt *et al.* 1998), which is not the case of headshields and shells. *Daphnia* spp. can be identified to the species level on the basis of shape of the headshield but usually headshields are not preserved in sediments, making more definite identification of subfossil remains impossible. Sometimes, fragments of shells are found which have the surface structure of squares or rectangles typical to *Daphnia* shells. However, because the fragments are small and crumbled they cannot be reliably identified.

Frey (1991) found and described headshields and shells of *Daphnia pulex* for the first time in *ca*. 10,000 years old sediments of a pond in Central Northern Greenland, where headshields were the most abundant remains. He also searched postabdomens, claws and mandibles in the 0.125 and 0.053 mm fractions, but these remains were absent. Manca & Comoli (2004) found *Daphnia* remains in sediments collected from a Himalayan lake. In these sediments the most abundant remains were headshields of *Daphnia tibetana*. The same type of headshields was also found in the living zooplankton of the lake.

MATERIAL AND METHODS

In the present study, well preserved shells, headshields, claws and ephippia of *Daphnia* were collected from sediments of two lakes.

An unnamed lake near lake Somas (in this paper we call it "Lake Somaslampi"), situated in NW Finnish Lapland, (69°15'N, 53°57', 758 m a.s.l.), is a small, arctic, oligotrophic lake with a surface area of 16.9 ha and depth of 10 m. A sediment core about 2.50 m long was taken in the spring of 2002 from the middle part of the lake.

Lake Wigry, situated in NW Poland (Wigierski National Park, 53°57' – 54°10' N and 22°51' – 23°15'' E) is mesotrophic and one of the largest lakes in Poland, with a surface area of 2187 ha, and average depth of *ca*. 45 m (the maximum depth – 73 m). The sediments are rich in carbonates. A 5.5 m long sediment core was retrieved from the southern basin, where the water depth was 22 m. This core represented a complete sediment stratigraphy from the Younger Dryas till today.

The sediment cores were taken with a modified Więckowski piston corer. Coring was done continuously in 1 m sections. In the laboratory, the cores were subsampled, mostly at 5 cm intervals. 1 cm^3 of fresh sediment from each subsample was analysed for Cladocera. Carbonates were removed with 10% HCl, then the remaining sediment was boiled for about 20 min in 10% KOH and then sieved with a 0.045 mm mesh. The residue was placed into a test tube and distilled water added until the volume was 10 cm^3. All cladoceran remains in each sample were counted at 100 – 400× magnification under the Olympus microscope. The present paper reports only the occurrence of *Daphnia* remains.

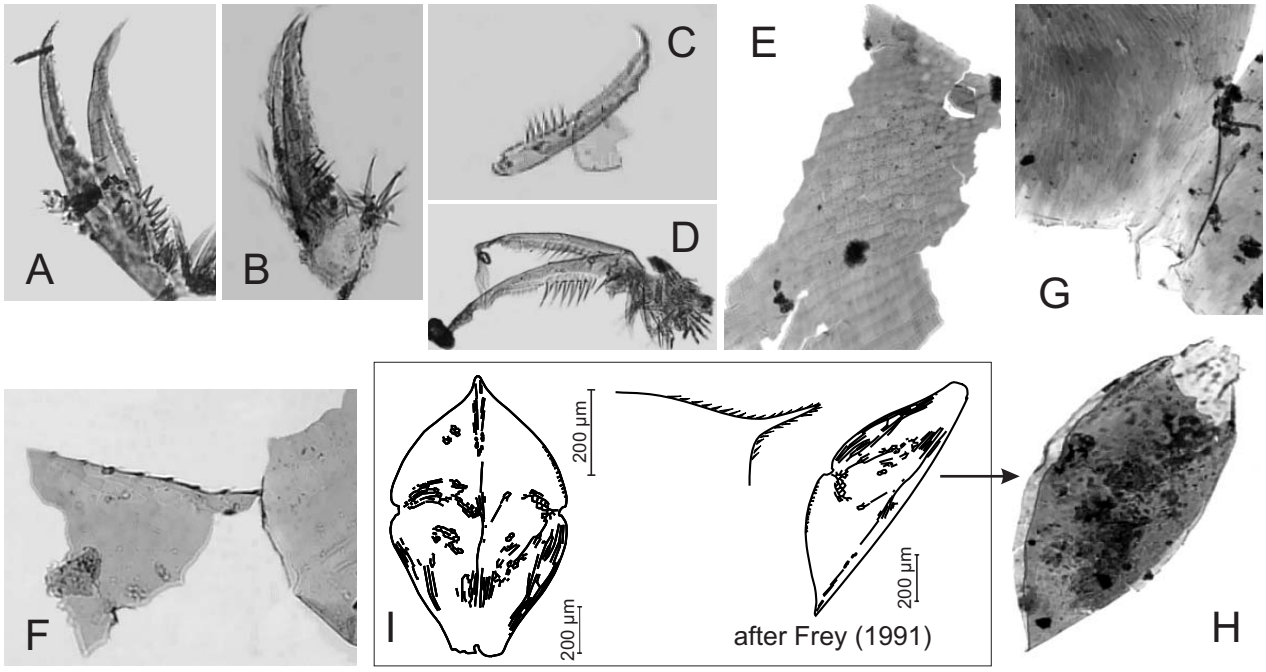

Fig. 1. Examples of collected remains of *Daphnia* sp. from the sediments of the Lake Somaslampi (NW Finnish Lapland) and of a pond in Central Northern Greenland (Frey 1991). **A–D** – different postabdominal claws of *Daphnia pulex* group (magn. 200×); **E–F** – fragments of the shells of *Daphnia sp*. (magn. 100×); **G–H** – headshields of *Daphnia pulex* group(G – magn. 200×); (H – magn. 100×); **I** – drawing after Frey (1991).

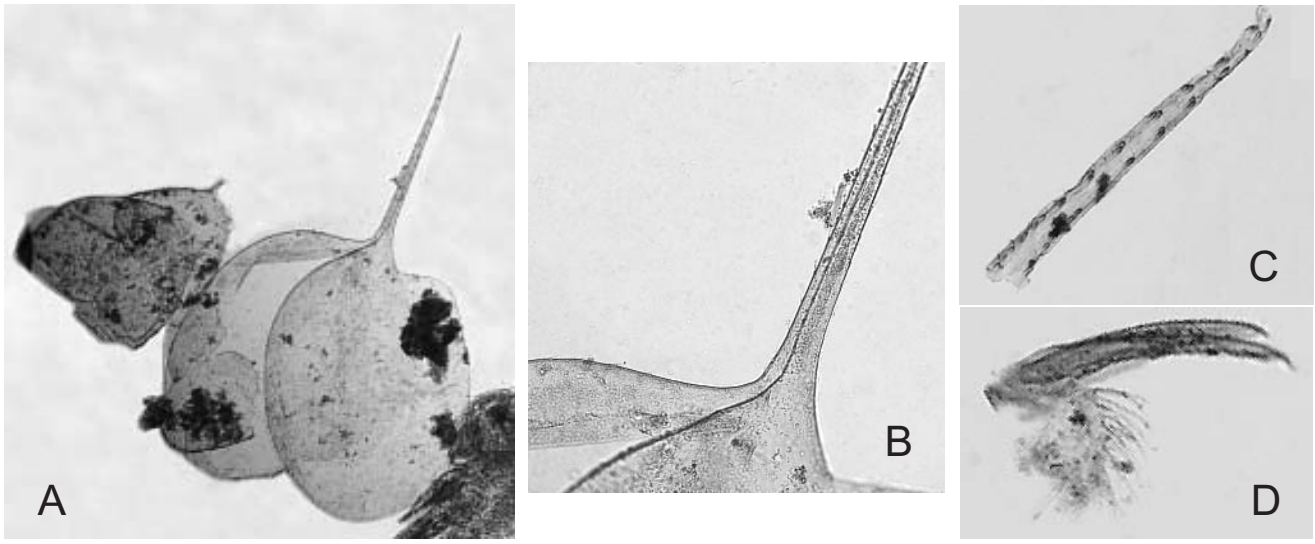

Fig. 2. Examples of collected remains of *Daphnia longispina* group from the sediments of Wigry Lake (NE Poland). **A–B** – shells; **C** – spine; **D** – postabdominal claw. A, B: found in contemporary sediments (A – magn. 60×), (B – magn. 200×); C, D: found in early Holocene sediments (magn. 200×).

RESULTS

In the early Holocene sediments of Lake Somaslampi headshields of *Daphnia* (Fig. 1) were found. The headshields are very similar to *Daphnia* remains described by Frey (1991) from Greenland. Probably the headshields found in Lapland and in Greenland belong to the same species of *Daphnia pulex* group. In addition the sediments from Lake Somaslampi contain also fragments of ephippia and claws.

The shell fragments with visible structure were preserved well enough to be identified as *Daphnia* spp. Also many *Daphnia* claws were found, with different shapes and numbers of teeth. Interestingly, basing on the length and the number of teeth, four types of claws of *Daphnia pulex* group could be distinguished (Fig. 1A–D). This suggests that at least four species of that group were living in Lake Somaslampi.

Well preserved *Daphnia* remains were also found in the Holocene sediments of Lake Wigry (Fig. 2), which is located in the coldest part of Poland. But in the early Holocene sedi-

ments mainly ephippia and claws belonging to *Daphnia longispina* group and *Daphnia pulex* group were found. In the uppermost sediments deposited during the last 50 years excellently preserved shells of *Daphnia longispina* group, were found too. However, no headshields were found.

DISCUSSION

Interestingly, in sediments of some lakes headshields and shells of *Daphnia* are well preserved, while in other lakes claws and ephippia only are found in good shape. All the *Daphnia* headshields and shells encountered so far descended from Greenland, Lapland and Himalaya regions. This suggested that climate may influence the degree of preservation of *Daphnia* species.

Probably it is a cold climate, which provokes *Daphnia* species to build up larger and thicker shell (Manca & Comoli 2004). Thus the number of moults and the body size depend on duration of ice free periods and on summer temperatures. Our observations confirm the thesis of Manca and Comoli (2004). The headshields and shells found in subarctic Lake Somaslampi were thick and had visible structure (Fig. 1). It seems that these thick shells were more resistant to bioturbation, sediment translocation and compression and therefore could preserve. In addition, in cold regions oligotrophic lakes dominate. The sedimentation in these lakes is slow, thus the pressure on the deposited remains is smaller. Under these conditions well preserved *Daphnia* fragments may be found, allowing for better identification. The shell remains found in the contemporary sediments of Lake Wigry seem to support that suggestion. These shells are also well preserved, but very thin and perhaps this is why they are lacking in older sediments. The obvious differences in preservation of *Daphnia* headshields and shells indicate that the subject needs plenty of further investigation of different lakes, climate and water chemistry.

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