Studia Quaternaria, vol. 24: 65–67.

DESCRIPTION OF SUBFOSSIL POST-ABDOMEN AND POST-ABDOMINAL CLAW OF *Ceriodaphnia* (CLADOCERA, DAPHNIIDAE)

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Abstract

Cladoceran remains preserve selectively in lake sediments. Possibly all Cladocera species leave at least some identifiable remains in lake sediments. Exosceletal body parts of families Chydoridae and Bosminidae preserve best but other families are only variably represented in sediments by their outer body parts. Identification of all possible remains helps to achieve more precise palaeolimnological reconstruction of past ecosystems by Cladocera analysis. This article describes, together with photograph and line drawing the subfossil post-abdomen and post-abdominal claw of *Ceriodaphnia*, previously not widely identified.

Key words: Cladocera, *Ceriodaphnia*, subfossil remains, identification

INTRODUCTION

Exoskeletons of planktonic and littoral Cladocera break into various outer body parts after death or moulting. The chitinous outer body parts, such as carapaces, head shields, ephippia, post-abdomens and claws preserve selectively in lake sediments, whereas all soft tissues decompose. Preservation is known to be the best in the families Bosminidae and Chydoridae as almost all body parts of these families preserve well (Frey 1986, Korhola, Rautio 2001). According to Frey (1986, 1991) body parts of the family Macrothricidae may also preserve well. Other Cladocera families are only variably represented in sediments by *e.g.* ephippia, post-abdominal claws, antennal segments and mandibles. Identification of these small, detached body parts is considerably more difficult than that of morphologically differentiated shells, headshields and post-abdomens (Frey 1986). Frey (1960) suggested that probably all Cladocera species leave some kind of remains in lake sediments, but the exact identification of these remains is problematic.

Subfossil Cladocera remains have been widely used in palaeolimnological studies providing information on past development of aquatic ecosystems and external changes in climate and lake surroundings (Frey 1986, Hann 1989, Korhola, Rautio 2001). Identification of subfossil Cladocera remains has been based on various articles about recent Cladocera and subfossil remains (*e.g.* Frey 1958, 1959, 1963, Goulden, Frey 1963) and faunistic publications (Flössner 1972, Røen 1995). However, all the remains cannot be identified to species level because of similar morphological characteristics or lack of detailed features *e.g.* with different species in the same genus. Thus the degree of taxonomic resolution is not always so high.

Several unknown subfossil post-abdomens and post-abdominal claws were encountered during the Cladocera analysis of surface sediment samples from two bog ponds, situated in southern Finland (Nevalainen, unpubl.). These were identified as *Ceriodaphnia* spp. post-abdomens and claws. The aim of this article is to describe these subfossil post-abdomens and post-abdominal claws belonging to genus *Ceriodaphnia* (Daphniidae), and thus increase the number of identifiable cladoceran remains.

MATERIAL AND METHODS

Surface sediment samples from two bog ponds (Lake Kalatoin 60° 20’ N, 24° 37’ E and Lake Jousjärv 60° 20’ N, 25° 11’ E) situated in southern Finland were prepared for Cladocera analysis by standard methods described in Korhola & Rautio (2001). The samples were heated and stirred in 10% KOH for 20 min and then washed through a 44 µm mesh. The samples were moulted in glycerine jelly stained with safranine to secure longer preservation of the microscopic slides. The subfossil *Ceriodaphnia* remains were identified with help of Flössner (1972), Røen (1995) and author’s own observations on intact *Ceriodaphnia* specimens. The remains were photographed from microscopic slides with the Olympus DP10 camera, which was attached to the Olympus BX40 light microscope.

DESCRIPTION OF *Ceriodaphnia* REMAINS

The post-abdomen and post-abdominal claw of *Ceriodaphnia* slightly resembles those of *Daphnia* spp. *Daphnia* remains are, however, usually of brownish colour, whereas *Ceriodaphnia* remains are light-coloured and stain light pink. *Daphnia* remains also have thicker and wavy setae on

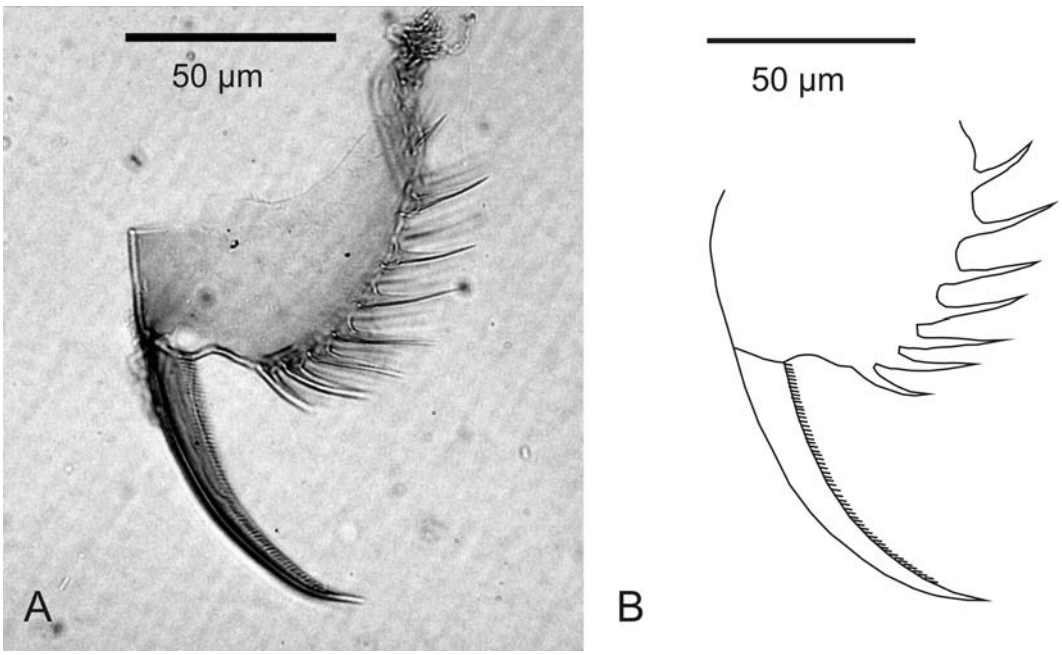

Fig. 1. The subfossil post-abdomen and post-abdominal claw of *Ceriodaphnia* in the photograph (**A**) and in the line drawing (**B**) from two different individuals from the surface sediments of Lake Kalatoin.

post-abdominal claws. The post-abdomen of *Ceriodaphnia* is small and short and lies always on its side (Fig. 1A). It has usually 6–7 thin, sharply curved and evenly sized teeth/spines on the dorsal margin and the proximal part of the post-abdomen is always detached or not preserved. The dorsal corner of the post-abdomen is rounded. The distal teeth begin at the dorsal corner of the post-abdomen, unlike in *Daphnia*, whose distal teeth begin at the base of the post-abdominal claw. The post-abdominal claw of *Ceriodaphnia* is slightly curved and small, straight setae cover the distal margin of the claw (Fig 1B).

DISCUSSION

Ceriodaphnia (Dana) is a Cladocera genus consisting of planktonic species. Most *Ceriodaphnia* species live in rather small lakes, in pelagic area or in littoral zone among vegetation (Røen 1995). Some species of this genus seem to be abundant in oligotrophic lakes, where other planktonic cladocerans are sparse and therefore *Ceriodaphnia* spp. play an important role of the aquatic food web of the lakes.

Frey (1964) identified several *Ceriodaphnia* species (*C. reticulata, C. pulchella, C. quadrangula* and *C. megalops*) from subfossil ephippia and post-abdomens, but did not describe them. Also Goulden (1964) recorded finds of different *Ceriodaphnia* species (*C. megalops*, *C. pulchella* and *C. quadrangula*) in the sediments. Apparently, Goulden (1964) identified *Ceriodaphnia* species on the basis to their subfossil ephippia and no record of post-abdomens was presented.

Ceriodaphnia is usually identified only as ephippia and as a genus from subfossil remains (*e.g.* Korhola 1990, Korhola, Rautio 2001). Since only ephippia of *Ceriodaphnia* are used to reconstruct past *Ceriodaphnia* populations, they are most likely to be underrepresented in lake sediments. The underrepresentation of *Ceriodaphnia* is due to the fact, that during most of the active period cladocerans reproduce asexually cloning themselves and ephippial females with resting eggs appear only during the sexual period in autumn. Therefore, if *Ceriodaphnia* post-abdomens and post-abdominal claws could be identified and enumerated in Cladocera analysis, it would give a more precise picture of the real abundance of it.

However, preservation of *Ceriodaphnia* post-abdomens and post-abdominal claws is probably highly selective in different lakes and sediments. The lakes in which the subfossil *Ceriodaphnia* remains were found, are both small bog ponds, with *Sphagnum* mosses covering the shores. Most likely, the sediments in these lakes are very rich in organic matter and therefore, the cladoceran remains preserve well. It is also possible that *Ceriodaphnia* post-abdomens and claws preserve only in lakes with certain water chemistry and sediment characteristics. It is also possible that they preserve only in recent sediments and decompose after a certain time. Because they were found in only two lakes, it is not possible to define the special lake characteristics. It remains now to be seen if *Ceriodaphnia* post-abdomens and claws will be found in older sediments. Despite, identification of *Ceriodaphnia* remains can offer a more accurate picture about planktonic Cladocera communities, at least in recent sediments.

Acknowledgements

This study was carried out under the funding of EPHIPPIUM-project, Academy of Finland (1107062). I wish to thank Kaarina Sarmaja-Korjonen for verifying the identification, discussing with me about the topic and improving the manuscript with helpful comments.

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