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# Crystalline cones from eyes of *Euphausia superba* Dana

ABSTRACT: The length of crystalline cones (cc) is proportional to krill body length and this proportion can be described by the equation L cc = L krill × 1.679 + 52.032 ( cc — μm; L krill — mm). By measuring cc one can determine the size of krill with the precision of 2–3 mm. The structure of crystalline cones is not crystal, and the elemental composition includes much of S and Ca. Crystalline cones are often found in the stomach and feces of animals feeding on krill.

K e y w o r d s : Antarctica, krill size, crystalline cones.

## Introduction

As all the euphausiids also *Euphausia superba* Dana has compound eyes (Kampa 1965, Mauchline and Fisher 1969). In each ommatidium there are two crystallie cone cells which form the bipartite crystalline cone (Denys, Adamian and Brown 1983). It has been the purpose of this work to determine the relationship between krill body length and the sizes of crystalline coes. Another aim was to analyse the structure of crystalline cones. Krill body length may also be determined from the measurement of krill eye diameter (Nemoto, Okiyama and Takahashi 1984) which, however, undergoes deformation in the stomach of the consumer. For this reason the measurement of crystalline cones appears to be more useful.

## Methods

30 freshly caught individuals of *Euphausia superba* Dana, 19–55 mm in length (from rostrum to the end of telson), were used for the measurements, 15 crystalline cones (cc) were removed from each krill eyes and their length and

diameter were determined under microscope. Optical photographs of the eye and crystalline cones were taken. Analysis of elements contained in crystalline cones (cc) was done with the help of the EDAX system (PV 9900).

## Results and discussion

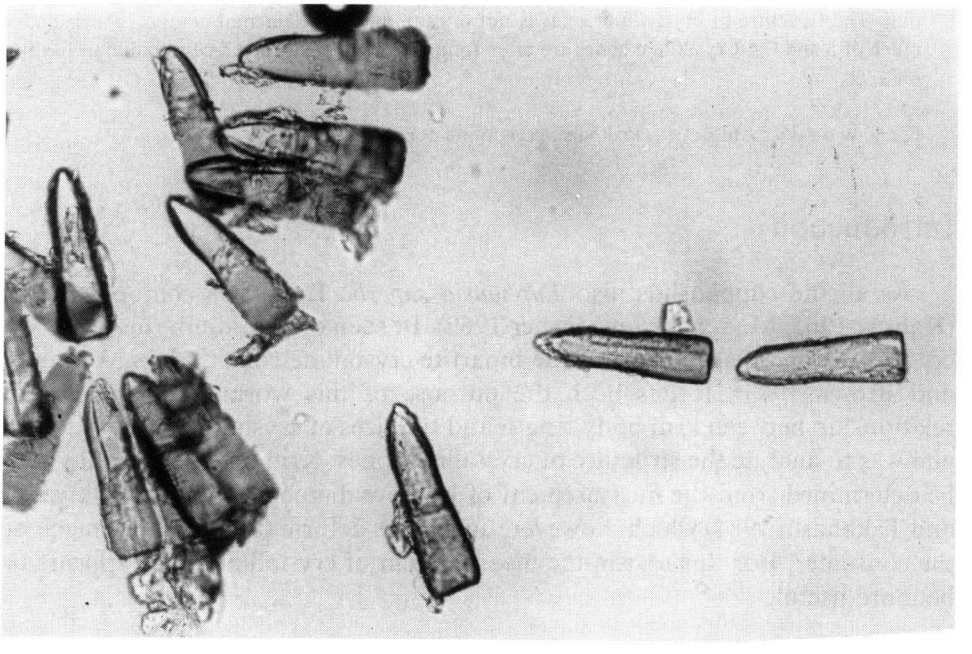
Crystalline cones (cc) in fresh krill samples are light in colour, almost transparent and soft. In material fixed with formaline cc are dark brown and hard (Photo 1), mean body length of 30 measured individuals of *E. superba* was 39.36 + - 11.77 mm; mean length of their crystalline cones (cc) was 118.13 +- 20.33 $\mu$m; the diameter of distal end was 34.04 +- 5.29 $\mu$m.

Relationship between krill body length of cc (Fig. 1) can be described by the linear regression equation:

$$Lcc = L\ krill \times 1.679 + 52.032$$

Krill length can be determined with the precision of 2–3 mm from the length of the largest cc contained in the eye:

$$L\ krill\ mm = \frac{L\ cc - 52.032}{1.679}$$



Phot. 1. Crystalline cones from krill eye (optical photography).

Relationship between cc length and its distal diameter (Fig. 2) can be described by the equation:

$$Dcc = Lcc \times 0.253 + 4.129$$

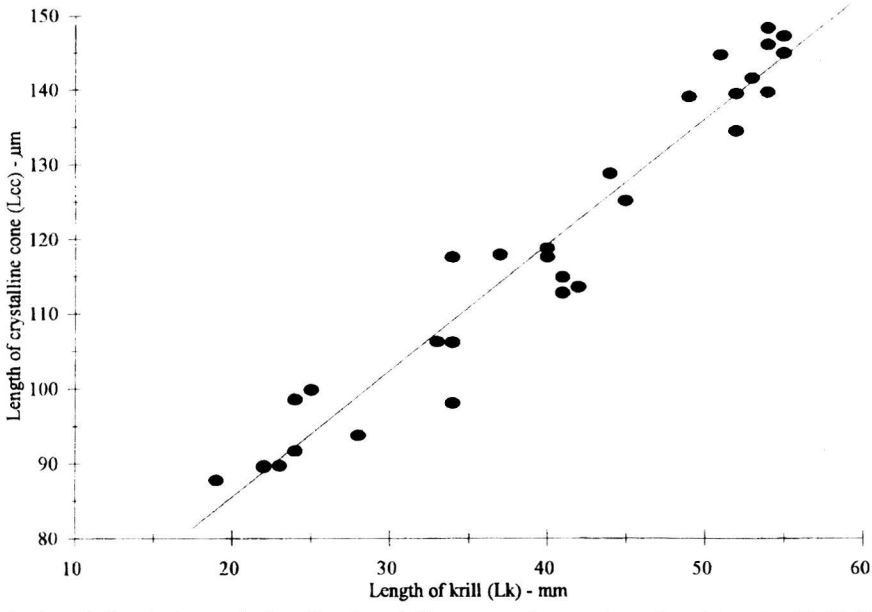



Fig. 1. Correlation between the length of crystalline cones (L cc — in $\mu$m) and length of krill (L krill — in mm). Each dot — mean values for 10–30 cc measurements. L cc = L krill × 1.679 + 52.032, r = 0.97, n = 30.

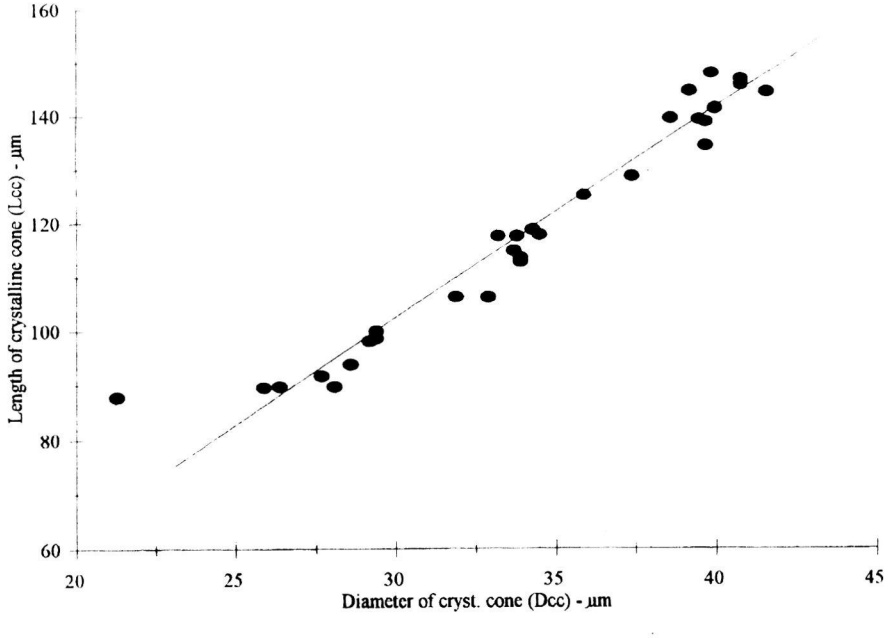



Fig. 2. Correlation between the length of crystalline cones (L cc — in $\mu$m) and its diameter (D cc — in $\mu$m). Each dot — mean values for 10–30 measurements. D cc = L cc × 0.253 + 4.129, r = 0.97, n = 30.

The growth rates of any of the internal organs relative to the entire body growth rates have not been examined in euphausiids (Mauchline and Fisher 1969). As shown by our measurements, the increase in cc length is directly proportional to the increase of krill body length. Diameter of crystalline cones also increases with their length.

Crystalline cones fixed with formaline and shown in a polarized light give sometimes effects which are characteristic of crystalline structure. Cc dissolve in $H_2O_2$, in 12% natrium hipochlorid, 8n $NaOH_2$, $H_2SO_4$ + $K_2Cr_2O_7$, they dissolve less in 10% HCl.

Microanalysis of crystalline cones (cc) reveals the presence of distinct peaks which correspond with the following elements: C, O, P, S and Ca. Especially notable is the high content of S which may indicate the presence of sulphur amino acids.

## References

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## Streszczenie

Długość stożków krystalicznych z ommatidiów oka złożonego *Euphausia superba* okazała się bardzo dobrze skorelowana z długością ciała tego skorupiaka. Zależność tych dwu długości opisuje równanie:

$$L\ cc = L\ krill \times 1.679 + 52.032$$

gdzie L cc = długość stożka krystalicznego w $\mu$m, zaś L krill = długość skorupiaka w mm. Mierząc stożek krystaliczny pod mikroskopem można określić długość całego zwierzęcia z dokładnością do 2–3 mm. Można wobec tego zależność tę wykorzystać np. przy badaniach populacyjnych kryla znajdowanego w żołądkach zwierząt odżywiających się tym skorupiakiem, bowiem stożki krystaliczne świetnie zachowują się w przewodach pokarmowych i w fekaliach.

W składzie chemicznym wykryto znaczne ilości siarki i wapnia.