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REJUVENATION IN COLONIES OF SOME ANTARCTIC TUBULIPORIDS (BRYOZOA, STENOLAEMATA)

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ABSTRACT

Six erect colonies with proximal rejuvenated portions belonging to *Idmidronea fraudulenta* Ostrovsky & Taylor, 1996, *Exidmonea arcuata* Ostrovsky & Taylor, 1996 and *Entalophoroecia* cf. *rogickiana* (Androsova, 1968) are described in detail. This is the first report of rejuvenation in colonies of Recent Tubuliporida. Conditions in which rejuvenation might occur are discussed as well as some terminological problems concerning this phenomenon.

INTRODUCTION

Up to now regeneration of colony fragments has only been recorded in a few groups of bryozoans. It is especially widespread within so-called "free-living" Bryozoa and appears to be connected with their life-pattern (see Marcus & Marcus 1962, Cook 1965a,b, and others). An exhaustive list of the studies of these cheilostomes is presented by Cook and Chimonides (1994). The formation of new colonies from the fragments, which is not always the same as regeneration (see below), was described in some fossil Stenolaemata (*Archimedes*, *Corynotrypa*, *Voigtopora* and *Stomatopora*) and Recent Eurystomata (*Pyripora*, *Cellarinella*, *Melicerita*, and some others) (see McKinney 1983, Boardman et al. 1983, Winston 1983, Taylor 1985, 1986, 1990, Reed 1991). Kluge (1975) reported on the existence of colonial regeneration in some ctenostomes referring to the book of Joliet published in 1877. This potential exists (Levinsen 1907, Silén 1977): the data on regeneration in different groups of bryozoans are briefly summarized by Reed (1991).

As to the term "regeneration", it has been usually used for the type of reparative growth mentioned above. However, the term is also often applied to regeneration/degeneration cycles of polypides in bryozoans. The dictionary definition of the term "rejuvenation" helps to avoid possible confusion. Boardman, McKinney and Taylor used "rejuvenation" for "the reversal of growth

direction proximal to broken ends of branches of *C[inctipora] elegans*" (1992: 12). This term was also used by the author in the present paper to describe different manifestations of the regenerative process in zooids as well as in colonies.

As seen from the above, the only erect stenolaematous bryozoans for which the formation of colonies from fragments has been recorded are the Paleozoic *Archimedes* and Recent *Cinctipora*. However, this was not a proximal rejuvenation, but budding of new colonies "from the whorl margins of older colonies" in *Archimedes* (McKinney 1983: 35), that may be compared with frontal rejuvenation in *Cinctipora*. So, the find of six colonies with rejuvenated portions belonging to three species of erect tubuliporids is of particular interest and importance. The colonies mentioned are described and some aspects concerning rejuvenation in bryozoans are discussed in this paper.

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MATERIALS AND METHODS

Three colonies with proximal rejuvenated portions of *Idmidronea fraudulenta* Ostrovsky & Taylor, 1996 and one colony with proximal rejuvenation of *Exidmonea arcuata* Ostrovsky & Taylor, 1996 were found in the bryozoan collection of the 34th Soviet (Russian) Antarctic Expedition (SAE-34) from the Princess Martha coastal waters (1988, sampling station 2/52, depth 394 m). Two colonies with proximal rejuvenated portions of *Entalophoroecia* cf. *rogickiana* (Androsova, 1968) were found in the collection of the SAE-36 from the Sea of Cosmonauts (1990, sampling station 11, depth 230-250 m). In both cases the bryozoans were dredged together with a thick felt of spicules of glass sponges. Numerous repaired zooids were found in colonies belonging to *Idmidronea hula* Borg, 1944, *I. obtecta* Borg, 1944, *Anguisia* sp. and *Filisparsa* sp. from the collections mentioned. Some of the specimens were coated with gold for SEM study. All specimens were preserved in alcohol and are kept in the Marine Research Laboratory (Polychaeta & Bryozoa Section) of the Zoological Institute of the Russian Academy of Sciences, St. Petersburg.

RESULTS

A repair or rejuvenation of the portions of damaged zooids is a very usual phenomenon in the colonies of Recent Antarctic tubuliporids. It occurs especially often in protruding portions of zooids: peristomes, ooeciostomes and dilated portions of gonozooids, and leads to total or partial restoration of the struc-

ture (Fig. 1A-D). It is noteworthy that in some colonies peristomes with calcareous diaphragms were found. Sometimes, the diaphragms are formed on the level of the zooidal apertures (Fig. 1E), whereas in other cases they are markedly below the apertures (Fig. 1F).

I found only one case where a "live" colony of *Idmidronea hula* was broken

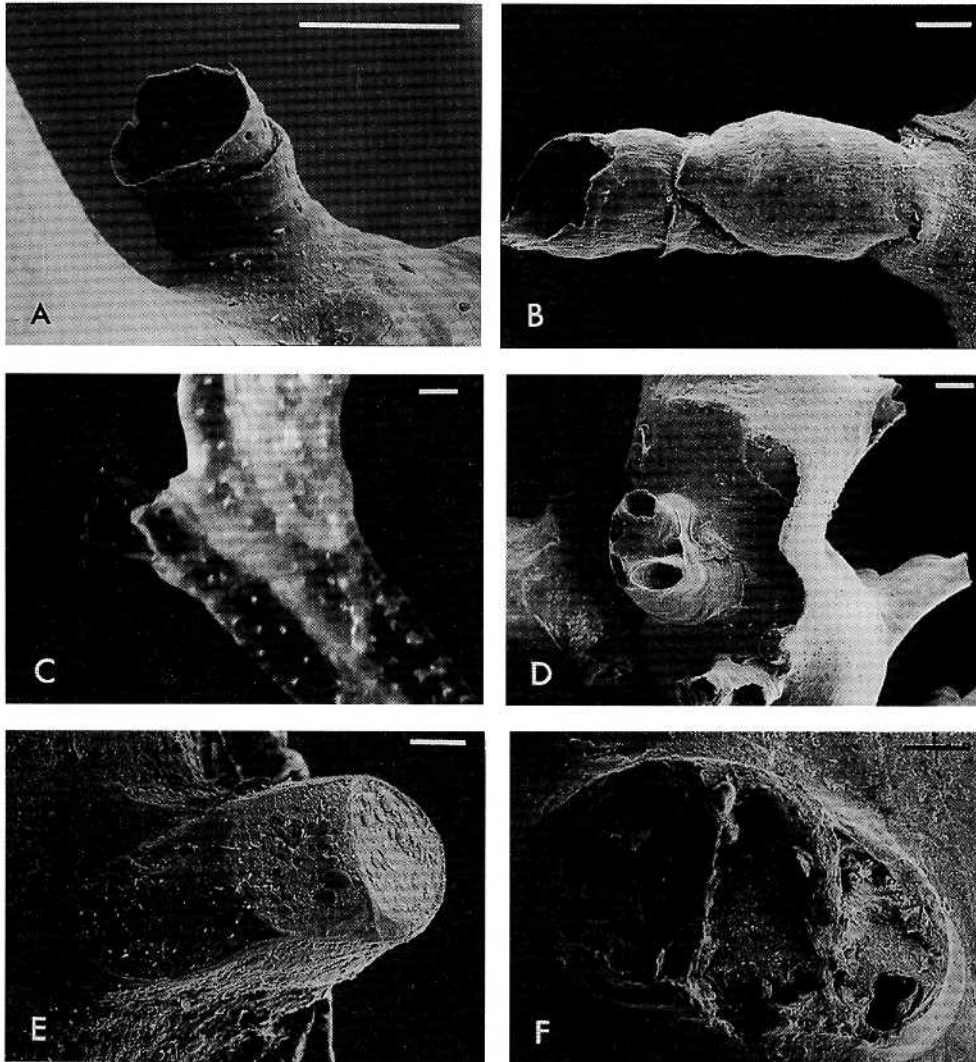


Fig. 1. A, D, *Idmidronea hula*: A, repaired oocystostome; D, repaired gonozooid. B, *Filisparsa* sp., repaired peristome. C, *Anguisia* sp., repaired peristome. E-F, *Idmidronea oblecta*, series of peristomes closed by calcareous diaphragms: E, in undamaged series; F, in series with broken peristomes. Scale bars: 100 μ m.

into two parts (Fig. 2A-B). The fertile (i. e. with gonozooid) colony is 6.5 mm long and the place of breakage is at a distance of 1 mm from the supporting disk. The width of the break is about 0.1 mm. The stem of the colony was broken on the basal side and only the innermost (frontal) autozooids looked untouched. The damage was so severe that it led to some displacement of the upper part of the colony in relation to the lower part. Nonetheless, the colony had "healed" the damaged portion although it had not restored it completely. Incidentally, the edges of the break almost entirely correspond to each other, so it seems likely that the colony was rather large when the break occurred.



Fig. 2. A-B, F, *Idmidronea hula*: A-B, colony repaired after breakage; F, colony with dorsal kenozooids (arrowhead). C-E, *Idmidronea fraudulentata*: C, specimen 1, dorsal view; D-E, specimen 3, frontal (D) and dorsal (E) views (for explanations see text). Scale bars: 500 μ m. Places of junction arrowed.

Colonies with proximal rejuvenated portions, that can be considered as a result of a restoration of the fragments to colonies after division, were found in three species (see below). No supporting disk or any supporting structures were found; newly formed portions arise from autozooids instead. In all cases the orientation of growth of the rejuvenated portions was exactly the opposite of that in the older ones.

Idmidronea fraudulenta Ostrovsky & Taylor, 1996

Figs. 2C-E, 3B

Specimen 1 (Fig. 2C). Adult sterile (without gonozooid) branching colony. Total length 17 mm, length of rejuvenated portion 0.4 mm.

The place of breakage, to all appearances, had recently been transformed to a new colonial budding zone ("common bud"). A new (i. e. rejuvenated) portion is in the beginning of its formation and consists of incipient zooids only. Its diameter is slightly larger than the diameter of the older colony portion.

Specimen 2 (Fig. 3B). Adult sterile branching colony. Total length 9 mm, length of rejuvenated portion 0.8 mm.

The diameter of the recently formed portion is about 2/3 that of the older stem, so the place of junction is easily observed. The "common bud" is "removed" from the place of breakage, but no peristomes have formed in the rejuvenated portion.

Specimen 3 (Fig. 2D-E). Adult sterile branching colony. Total length 15.5 mm, length of rejuvenated portion 1.4 mm.

The older stem is represented by a series of two autozooids at the place of junction whereas the new portion is begun from two individual autozooids with alternating peristomes, similar to the initial stage of many tubuliporids. Two series of two zooids follow the two first zooids on both sides of the rejuvenated stem, which is slightly curved backwards, so the place of junction is easily seen. Also a transverse suture formed by interzooidal walls of autozooids of both portions is located here.

Judging from the good preservation of the skeletons, the colonies described were alive at the moment of capture.

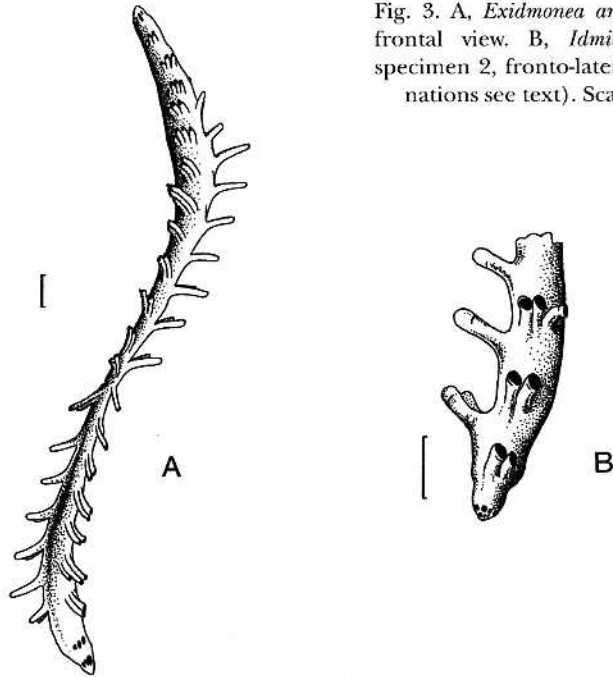
Exidmonea arcuata Ostrovsky & Taylor, 1996

Fig. 3A

Specimen 4. Adult sterile unbranched colony. Total length 9.4 mm, length of rejuvenated portion 4.5 mm.

Both colony portions are normal branches and have approximately the

Fig. 3. A, *Exidmonea arcuata*: specimen 4, frontal view. B, *Idmidronea fraudulenta*: specimen 2, fronto-lateral view (for explanations see text). Scale bars: 500 μ m.



same size, so it is possible to recognize a new branch only by observing its junction with the main stem. One of the portions is begun from the series of two autozooids whereas the other one is begun from an individual autozooid in a manner similar to that in Specimen 3 of *Idmidronea fraudulenta*. The place of breakage has the appearance of a ring furrow.

It is likely that the colony was dead at the moment of capture: zooidal walls are almost opaque and have a brown coloration.

Entalophoroecia cf. rogickiana (Androsova, 1968)

Fig. 4

Specimen 5 (Fig. 4A-B). Short broken colony. Total length 5 mm, length of rejuvenated portion 2.3 mm.

The colony consists of two parts of approximately the same size and diameter. Autozooidal walls are semitransparent and have a yellow coloration in the older portion, but they are entirely transparent and bluish in the new one. The base of the younger portion is thickened. Moreover, the place of junction is marked by a concavity on the one side of the colony and by a ring furrow on the other one (Fig. 4B). In two cases the tubes of autozooids of a new portion were a direct prolongation of autozooids of the older portion, but their peristomes were oriented in the opposite direction.

