

On a Dinoflagellate Bloom (*Plectodinium nucleovolvatum* Biech) Causing 'Red Water' in Pietà Creek (Malta)

A bloom of the dinoflagellate *Plectodinium nucleovolvatum* (Biech.) causing 'red water' has been observed in Pietà Creek, Malta. Blooms due to this organism do not appear to have been reported in the literature.

Reddish brown water occurred between 6 April and 14 May 1968 in a patch of water extending for about half a mile in the creek. Microscopical observation revealed that the phenomenon was caused by the mass occurrence of the dinoflagellate *P. nucleovolvatum*. TRÉGOUBOFF and ROSE¹ give an illustration and a simple description of this organism to which reference is made. The dinoflagellates are pear-shaped with a conical apex curved to one side and a tail-like appendage on one side at the rounded base. They appear green in transmitted light and give a brownish tinge to water in plastic containers. On centrifuging they collect as a greyish brown mass.

During the bloom period water samples from the upper foot of the sea were collected almost daily from the same spot in Pietà Creek. The heaviest aggregation during daylight hours seemed to be concentrated mainly at the surface. A small quantity of each sample was put in a test-tube after vigorous shaking. To this a few drops of formalin were added, the tube contents were thoroughly mixed, and a drop of the suspension was transferred by a pipette to a hemocytometer slide and the dinoflagellates were counted.

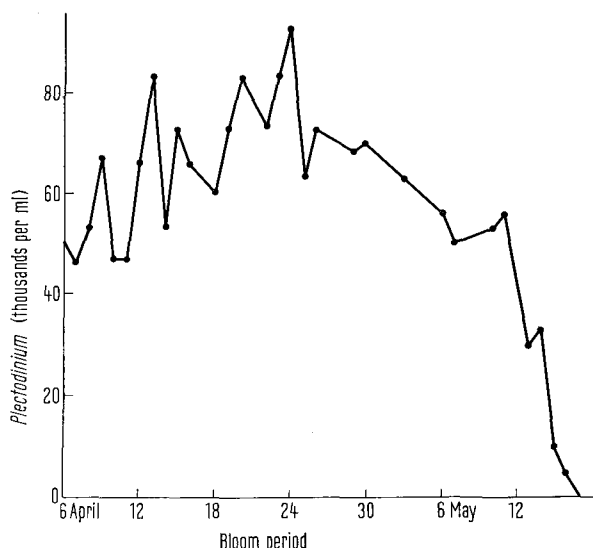
The daily mean counts of individuals present per millilitre water during the *Plectodinium* bloom are shown in the Figure. Masses of the organisms accumulated as a thick grey scum on the surface at the inner end of the creek. Cell counts here gave values of 250,000–420,000 individuals per millilitre water.

The bloom lasted up to 14 May, then rapidly dwindled away and no traces of the organism could be found 3 days later. Dispersal was probably due to wind. By and large the bloom coincided with a period of warming water (temperature 16.0–18.5°C) and relatively calm weather, conditions considered to be significant factors in the promotion of dinoflagellate blooms². Lack of rainwater dilution and the absence of strong winds during the bloom period also appear to lend support to MARGALEF's³ belief in the necessity of stable water conditions for 'red water' to develop.

Dinoflagellates have been known to cause mass mortalities among fishes and other marine organisms⁴. Consequently sporadic inspections of the surface and the sea-bottom by skin diving were carried out in the *Plectodinium* bloom area. However, there were no signs of death among fish and other marine animals as far as could be ascertained, and, in the absence of such evidence, it is not unreasonable to surmise that *Plectodinium* is a non-toxic organism forming a normal part of zooplankton and possibly constituting a potential food source for marine animals.

The lamellibranch *Crassostrea virginica* has been observed feeding on the dinoflagellate *Amphidinium fusiforme* during a 'red water' bloom and other consumers of dinoflagellates have been reported in the literature⁵. ODUM⁵ observed the juvenile forms of the mullets *Mugil cephalus* and *Mugil curmea* feeding almost exclusively on *Kryptoperidinium* near the air-water interface during a 4-day period of this dinoflagellate bloom in an estuarine river in Georgia, and when the bloom disappeared, they reverted to their normal benthic diet of diatoms, plant detritus and sediment particles. It would, therefore, be

of interest to make similar studies locally as well as to discover what organisms form blooms from time to time in Maltese waters, since blooms are known to have occurred locally in the past but no records exist about the organisms which caused them.



Counts of *Plectodinium nucleovolvatum* during red bloom.

Riassunto. Un'efflorescenza del dinoflagellato *Plectodinium nucleovolvatum* (Biech.) causando 'mare rosso' fu osservata nella cala della Pietà a Malta. Questo fenomeno avvenne in un periodo quando la temperatura s'aggravava fra 16,0 e 18,5°C in condizioni climatiche più o meno calme. Non ci pare che esistono simili rapporti su *Plectodinium* nella letteratura. Ispezioni della zona affettata dalla colorazione non hanno rivelato alcun segno di tossicità di questo organismo sulla vita dei pesci ed invertebrati marini.

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¹ G. TRÉGOUBOFF and M. ROSE, *Manuel de Planctonologie Méditerranéenne* (Centre National de la Recherche Scientifique, Paris 1957).

² G. A. ROUNSFELL and W. R. NELSON, Univ. Alabama tech. Rep. 64, 1 (1964).

³ R. MARGALEF, *Adv. Frontiers Plant Sci.* 2, 137 (1963).

⁴ F. S. RUSSELL, *Adv. mar. Biol.* 3, 255 (1965).

⁵ W. E. ODUM, *Chesapeake Sci.* 9, 202 (1968).