# The Phytoplankton composition and population enrichment in gelatinous "macroaggregates" in the Northern Adriatic during the Summer of 1989

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## *Summary*

*Phytoplankton cell densities in the gelatinous "macroaggregates" were up to 4 orders of magnitude higher than in surrounding water. Microplankton exhibited the highest enrichment factors relative to nano- and picoplankton (20X and 12X respectively). A high association of the diatoms Nitzschia longissima and Nitzschia closterium with the "macroaggregates" suggested aggregate formation at an earlier time or site.*

In the summer of 1988 and 1989 dense patches of large (up to 2m maximum dimension) gelatinous mucous "macroaggregates" were observed in the northern Adriatic Sea. The brownish-yellow masses were initially observed in the upper water column, or floating at the surface where they often coalesced into extensive "blankets". Subsequently, the gelatinous masses extended throughout the water column, and by early autumn had settled to the bottom. The "macroaggregates" were similar to but very much larger than "marine snow" aggregates reported from other regions.

Samples were collected along an east-west trans-Adriatic trophic gradient between the Po delta, Italy and the Istrian peninsula, Yugoslavia. Eight to ten "macroaggregates" were collected in syringes by divers at 10 meters, together with samples of the "surrounding" water, fixed with formaldehyde, and stored at 2-3°C until enumeration. Collected "macroaggregates" (N=72) with volumes ranging from 2.5 to 17 ml, were subsequently homogenized and pico- and nanoplankton counted by fluorescence microscopy. Microplankton samples were enumerated by the Utermohl method (Hasle, 1978).

The average population densities of all three size classes in the seawater increased from east to west toward the Po delta area. In contrast, the "macroaggregate" population densities, with the exception of the nanoplankton component, did not exhibit a significant east to west gradient. In fact, there was a tendency for the micro- and picoplankton densities to be higher in the "macroaggregates" at the eastern station.

Densities of all phytoplankton size classes were enriched in "macroaggregates" relative to the surrounding seawater, although the degree varied among different fractions. The levels of enrichment ranged up to four orders of magnitude. The average enrichment factors for the picoplankton ranged from 38 to 668, with means ca. 5-fold higher at the eastern relative to the western side of the transect. The average nanoplankton enrichment factors ranged from 46 to 491, with similar means at the eastern and western sides. The average microplankton enrichment factors ranged from 227 to 13,009, with means 3 to 5-fold higher at the eastern side. The microplankton enrichment was ca. 12-fold higher than the nanoplankton and ca. 20-fold higher than the picoplankton.

The "macroaggregate" enrichment by some microplankton species exceeded 4-5 orders of magnitude. The diatoms Nitzschia longissima/N. closterium showed the highest association with an average enrichment of 12,236X (c.v. 67; n = 64) relative to the surrounding water at 10 m. This strongly suggests that the "macroaggregates" may have accumulated this particular component earlier in time or at a different site. Nitzschia longissima/N. closterium, both temporally and spatially, was the dominant microplankton component in the "macroaggregates", irrespective of changes in the species composition of the microplankton in the surrounding water.

The microplankton population densities in the seawater at the "macroaggregate" collection depth (10 m), were very significantly correlated with the cell densities of "other" species, indicating that species other than Nitzschia longissima/N. closterium made up the bulk of the microplankton population at that depth. However, microplankton cell densities at the surface were strongly correlated with the Nitzschia longissima/N. closterium cell densities, suggesting that this component contributed significantly to the microplankton population at the surface. These interrelationships imply a "macroaggregate" origin higher in the water column than the 10 m depth where they were collected.

## *Conclusions*

- The temporal variations of microplankton cell densities in "macroaggregates" did not reflect variations in cell densities in the surrounding water (c.v. 45 vs 140) indicating that contemporary processes in the "macroaggregates" were independent of those in the surrounding water.
- Very significant correlations between enrichment factors and "macroaggregate" cell densities, combined with poor correlations with seawater cell densities, suggest that growth within the "macroaggregate" was more dependent on the environment within the "macroaggregate" than on contemporary process in the surrounding seawater.
- A consistent dominance by Nitzschia longissima/N. closterium of "macroaggregate" microplankton, in spite of changes in the dominance rank in the surrounding seawater community, further implies that Nitzschia became embedded in the gelatinous matrix at an early stage of "macroaggregate" formation.
- Collectively these tentative conclusions support the concept that the origin of the "marcoaggregates" occurred at an earlier time and/or different site than where they were collected.

## *References*

Hasle, G. 1978. The inverted microscope methods I: Sournia, A. (ed.). Phytoplankton Manual. Monographs on Oceanographic Methodology 6. Paris, pp. 88-96.