ANTARCTIC JOURNAL OF THE U.S., Vol. XXVII(5):158-159, 1992.

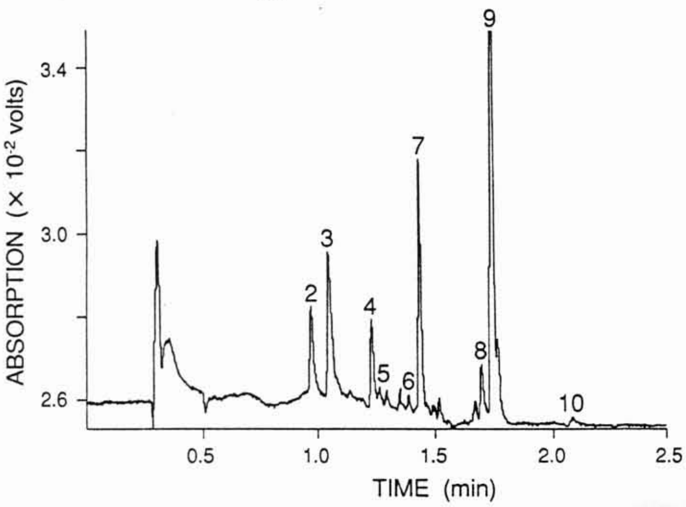

Figure 2. Chromatogram of 5-meter sample at St. FC58. Pigment identification: (1) chlorophyll $c_2+c_1$2) alloxanthin, (3) crocoxanthin, (4) chlorophyll *a*, and (5) ß-carotene.

adapted cells. This pattern supports the hypothesis of low-light adapted populations (Sosik et al. this issue).

These two populations had other distinct characteristics such as cell size (Holm-Hansen and Vernet this issue) and pigment-specific absorption coefficient (Brody et al. this issue), which in addition to affecting chlorophyll estimations from remote sensing (Frouin et al. this issue) and light transmission in the water (Panouse this issue) should affect sedimentation and grazing patterns and thus sustain very different trophic webs.

This work was supported by National Science Foundation grant DPP 88-17635. I would like to thank the captain and crew of the R/V *Polar Duke*, and all the RACER participants for an excellent cruise and C. Fair, M. Ferrario, and E. Sar for help during the sampling.

References

Brody, E., B. G. Mitchell, O. Holm-Hansen, and M. Vernet. 1992. Species-dependent variations of the absorption coefficient in the Gerlache Strait. *Antarctic Journal of the U.S.*, this issue.

Holm-Hansen, O. and M. Vernet. 1992. RACER: Distribution, abundance, and productivity of phytoplankton in Gerlache Strait during austral summer. *Antarctic Journal of the U.S.*, this issue.

Panouse, M. 1992. Attenuation and backscattering of natural light in the waters of the Gerlache Strait, Antarctica. *Antarctic Journal of the U.S.*, this issue.

Sosik, H., M. Vernet, and B. G. Mitchell. 1992. A comparison of particulate absorption properties between high- and mid-latitude surface waters. *Antarctic Journal of the U.S.*, this issue.

RACER: Phytoplankton populations in the Gerlache Strait

MARTHA E. FERRARIO AND EUGENIA SAR

Division Ficologia
Facultad de Ciencias Naturales
y Museo Universidad Nacional de La Plata
1900 La Plata, Argentina

An overview of the current knowledge of phytoplankton standing stock and rates of primary production in all waters south of the polar front in the southern ocean has shown an overall low level of phytoplankton and growth (El-Sayed 1987) even though nutrients are apparently never limiting (Committee to Evaluate Antarctic Marine Ecosystem Research 1981). Despite that, high phytoplankton biomass and rates of primary production occur in the coastal areas near the Antarctic Peninsula (Holm-Hansen et al. 1987). One of these areas, the Gerlache Strait (Holm-Hansen and Mitchell 1991), was studied as part of the Research on Antarctic Coastal Ecosystem Rates (RACER) program. The objective was to understand the mechanisms, formation, and decline of massive blooms present in the antarctic coastal ecosystem. Results from the pilot study in 1986-1987 showed a change in cell size distribution from predominantly microplankton in December to predominantly nanoplankton during the decline of the bloom (Holm-Hansen and Mitchell 1991).

Our research was designed to address the following objectives: analyze the structure of the phytoplankton population; establish the quantitative and qualitative species composition of the phytoplankton; determine at which period of the bloom and under which environmental conditions resting spores develop; and establish the utility of diatoms found in the area of the Gerlache Strait as tracers of water masses.

Samples from the water column and surface water were made on board the R/V *Polar Duke* from 9 December 1991 to 3 January 1992. At each station samples were taken from 10-liter Niskin bottles attached to a conductivity-temperature-depth (CTD) rossette. Depth profile water samples were taken from 0 to 150 meters and surface samples were taken with a 35 micrometer-mesh net. Quantitative samples were preserved in Lugol's iodine solution while qualitative samples were preserved in buffered formalin. Determination of species and cell number will be made by inverted microscope counts (Utermohl 1958).

Preliminary qualitative analysis of phytoplankton net hauls showed that, aside from relative abundances, surface species greater than 35 micrometers were more or less similar at all stations. Phytoplankton populations were composed not only of diatoms, but of flagellates as well. Diatoms characteristic of both water column and ice were observed. The most common groups were *Nitzschia*, *Frangilariopsis*, and *Nitzschiella* groups. These included mainly *N.cylindrus* (Grun) Hasle, *N.kerquelensis* (O'Meara) Hasle, and *N.closterium* (Ehrenberg) Smith. Other diatoms present were *Chaetoceros* genus including abundant species, mainly *C.socialis* Lauder, *C.neglectum* Karsten, *C.criophilum* Castracane, *C.tortissimus* Gran, *C.constrictum* Gran, and *C.flexuosus* Mangin. *Thalassiosira* spp. were represented by *T.gravida* Cleve, *T.scotia* Fryxell and Hoban, and *T. antarctica* Comber. Other species were *Probiscia alata* (Brightwell) Sundstrom, *Rhizosolenia truncata* Karsten, *Corethron criophilum* Castracane, *Eucampia antarctica var. recta* (Mangin) Fryxell, and Prassad. In some stations we found *Coscinodiscus bouvet* Karsten, *Porosira pseudodenticulata* (Husted) Lagrerheim, and *Nitzschia stellata* Mangin; these have a circumpolar distribution (Garrison 1991; Medlin and Hasle 1990). Typical benthic diatoms such as *Achnanthes* and *Cocconeis* were also observed, mainly in the ice-melting zone. A few dinoflagellates belonging to genus *Protoperidinium* and *Gymnodinium* as well as flagellates belonging to *Crytomonas, Pyramimonas,* and *Clamydomonas* were present.

Garrison (1984) and Sicko-Goad et al. (1989) have suggested that a "resting state" is involved in the survival of coastal diatoms and that those species which have no recognized resting spores survive in the vegetative state. In surface and water column samples, resting spore formation, sexual cycle processes and even resting spores themselves were observed. The largest number of species found with resting spores were in the genus *Chaetoceros*, mainly *C.neglectum, C.constrictus,* and *C.socialis* as well as in *T.scotia. Corethron criophilum* (a cosmopolitan species found frequently in the phytoplankton population of antarctic shore waters) was present in different phases and sizes. Dividing cells and sexual processes with auxospore formation were seen. The auxospores often quadrupled the diameter of the mother cell.

Male cells with differing numbers of spermatogonia were observed in this species and in *Odontella weisflogii* (Jonisch) Grunow. *Eucampia antarctica* (Castracane) Mangin (a species that is better preserved than many planktonic species and considered to be a good indicator in antarctic water sediments) (Koslova 1966) has had taxonomical and nomenclature problems. It was referred to by different generic and specific names, the most common being *Hemiaulus antarcticus* Ehrenberg and *Eucampia balaustrium* Castracane. Fryxell et al. (1989b) clarified these problems and recognized two new insights into *E.antarctica* (Fryxell et al. 1989a; Fryxell and Prasad 1990). One of these, *E.antarctica var recta* (Mangin) Fryxell and Prasad, a species with polar distribution, was present in our samples. In the field it was distinguished by straight chains in broad girdle view or slightly curved in narrow girdle view. The winter growth stage was represented by a heavily silicified frustule that resembles a resting spore (Fryxell 1991). Cells characterized by a circular, dense cytoplasmic mass positioned in their center, were tentatively identified as a resting stage cell of *Eucampia antarctica var recta*.

Phaeocystis pouchettii (Hariot) Lagerheim (recorded as an important species of the spring bloom in the antarctic and arctic ecosystems as well as in some temperate and boreal waters) (Estep et al. 1990) was present in the sampling grid. This is a member of *Prymnesiophyceae*, which has a polymorphic cycle with two phases. One phase is a palmeloid colony characterized by having different sizes and shapes of cells. The other is an unicellular and motile stage (2 to 8 micrometer) with two flagella and a haptonema (Sourina 1988; Parke et al. 1971). In addition, this species (present in and under the ice as well as in open waters) (Fryxell et al. 1988; Garrison 1991) has also been the object of physiological studies (listed by Estrada and Delgado 1990). It has been suggested that *P.pouchettii* has an inhibitory effect upon zooplankton predation. However, Estep et al. (1990) showed that predation on this species was dependent upon the physiology condition of the colonies, specifically, unhealthy colonies are consumed. Small rosettes of cells and large gelatinous colonies of *P.pouchettii*, an important component of the phytoplankton net hauls, were present in the southern stations in the Gerlache Strait.

Preliminary data using the Utermohl method on the stations dominated by nanoplankton (less than 20 micrometer) in the western and northern areas of the Gerlache Strait showed that the phytoplankton cells were totally dominated by *Cryptomonas cf. acuta* Butcher (3.071×10^6 cell/l) with a chlorophyll *a* concentration of 15.4 microgram l^{-1}. The concentrations of chl-*a* and total phytoplankton cells in the southern stations, i.e., FC41 (with chl-*a* 14.5 microgram/l at 2 meters) were represented by different groups, mainly diatoms and flagellates. The latter included *Cryptomonas, Pyramimonas* and *Clamydomonas* in 17 percent, 19 percent, and 0.8 percent respectively. *P.pouchettii* represented 32 percent with 1×10^5 cells/l, unlike station R101 at the ice edge (21.8 microgram chl-*a*/ l at 5 meters), where it represented about 67 percent with 1.22×10^6 cells per liter.

Finally zooplankton grazing was indicated by fecal pellets observed in some stations. These were of different size, round and cylindrical in shape, filled with empty frustules, almost exclusively with *Thalassiosira* spp. and the small *Nitzschia cylindrus*.

We would like to thank the captain and crew of the R/V *Polar Duke* as well as the members of the scientific party for assistance during the cruise. This work was supported by National Science Foundation grant DPP 88-17635.

References

El-Sayed, S. Z. 1987. Biological productivity of antarctic waters: Present paradoxes and emerging paradigms. *BIOMASS Scientific Series*, 7:1-22.

Estep, K. W., H. C. H. Nejstgaard, B. R. Skjoldal, F. Rey. 1990. Predation by copepods upon natural populations of *Phaeocystis pouchetti* as a function of the physiological state of the prey. *Marine Ecology Progress Series*, 67:235-249.

Estrada, M. and M. Delgado. 1990. Summer phytoplankton distribution in the Weddell Sea. *Polar Biology*, 10:441-449.

Fryxell, G. A. 1991. Comparison of winter and summer growth stages of the diatom *Eucampia antarctica* from the Kerguelen plateau and south of the antarctic convergence zone. *Proceedings of Ocean Drilling Program, Scientific Results*, 119:675-685.

Fryxell, G. A. and S. Party. 1968. Southern Indian Ocean cruise of the JOIDES Resolution (Ocean Drilling Program leg 119). *Antarctic Journal of the U.S.*, 23(5):128-131.

Fryxell, G. A. and A. K. S. K. Prasad. 1990. *Eucampia antarctica var recta* (Mangin) stat. nov. (Buddulphiaceae, Bacillariophyceae): Life stages at the Weddell Sea ice edge. *Phycologia*, 29(1):27-38.

Fryxell, G. A., S. H. Kang, and T. K. Ashworth. 1989a. AMERIEZ 1988 and ODP leg 119: Antarctic phytoplankton summer and winter stage indicators. *Antarctic Journal of the U.S.*, 24(5):156-157.

Fryxell, G. A., A. K. S. K. Prasad, and P. A. Fryxell. 1989b. *Eucampia antarctica* (Castracane) Mangin (Bacillariophyta): Complex nomenclatural and taxonomic history. *Taxonomy*, 38(4):639-640.

Garrison, D. L. 1984. Planktonic diatoms. In K. S. Stridinger and L.M. Walker (Eds.), *Marine Phytoplankton Life Cycle Strategies*. Boca Raton, Florida: CR.C. Press, 1-17.

Garrison, D. L. 1991. Antarctic sea ice biota. *American Zoology*, 31:17-33.

Holm-Hansen, O. and B. G. Mitchell. 1991. Spatial and temporal distribution of phytoplankton and primary production in the western Bransfield Strait Region. *Deep-Sea Research*, 38:961-980.

Holm-Hansen, O., R. Letelier, and B. G. Mitchell. 1987. RACER: Temporal and spatial distribution of phytoplankton biomass and primary production. *Antarctic Journal of the U.S.*, 22(5):142-144.

Kozlova, O. G. 1966. *Diatom of the Indian and Pacific sectors of the Antarctic.* Jerusalem: S. Monson.

Medlin, L. K. and G. R. Hasle. 1990. Some *Nitzschia* and related diatom species from Fast Lee samples in the Arctic and Antarctic. *Polar Biology*, 10:451-479.

Parke, M., J. C. Green, and I. Manton. 1971. Observations on the fine structure of zoida of the genus *Phaeocystis* (Baptophyceae). *Journal of Marine Biology Association of the U.K.*, 51:927-941.

Sicko-Goad, L., E. F. Stoermer, and J. P. Kociolek. 1989. Diatom resting, cell rejuvenation and formation: Lime course, species records and distribution. *Journal of Plankton Research*, 11(2):375-389.

Steele, J. H. (Ed.). 1981. *An evaluation of antarctic marine ecosystem research.* Washington, D.C.: National Academy Press.

Utermohl, H. 1958. Zur Vervollkommnung der quantitativen Phytoplankton-Methodik. Mitt. Int. Ver. Theor. Angew. *Limnology*, 9:1-38.