

THE TROPIC RESOURCE CONTINUUM MODEL AND PALEOGENE
PLANKTONIC FORAMINIFERA

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Nutrients, including fixed nitrogen, phosphorus, and trace elements are essential for the production of organic matter by photosynthesis. Nutrient flux serves as one mechanism by which astronomic, geologic, meteorologic, and oceanographic processes influence the biosphere. The Trophic Resource Continuum Model, deduced from studies of modern plankton communities and foraminifera, makes the following predictions concerning Paleogene age planktonic foraminifera:

1. Moderately eutrophic times or well-mixed surface waters should produce relatively low diversity, high dominance foraminiferal faunas in the euphotic zone; extreme eutrophy could produce oligotaxic assemblages from which foraminifera are largely excluded; faunas would be composed of generalist and opportunistic species demonstrating high ecophenotypic variability; these would be times of heightened meridional thermal contrasts and invigorated ocean circulation, or could be caused by an episode of rapid mixing through the euphotic zone. This scenario is illustrated by the earliest Paleocene and Early Oligocene.

2. More oligotrophic conditions or times would be characterized by higher diversities among epipelagic and tropical foraminifera, lower specific dominance, and increased numbers of specialists; meridional thermal contrasts would be lower and the region of warm surface waters would expand; the thermocline and the chlorophyll maximum may deepen at lower latitudes; nutrients may be concentrated at the base of the thermocline; this is illustrated by the Early Eocene.

3. Evolution from relatively eutrophic to relatively oligotrophic conditions after an ocean mixing event would result in the gradual development of new euphotic niches while the warm zone of the mixed layer expands, and diversification of specialized epipelagic foraminifera; under unusually warm conditions, decreased production or warm upwelling may result in lower abundances of fertility-related species; cool water groups may evolve or simply change their geography; this is illustrated by the latest Paleocene and the Late Oligocene.

4. Evolution from relatively oligotrophic to relatively eutrophic conditions with the beginning of ocean mixing should result in the elimination of niches in the euphotic zone and decreased diversities of warm water groups; mesopelagic groups may evolve due to the changed thermal structure of their habitat and decreased nutrient availability, as nutrients are more efficiently circulated through the thermocline; this is illustrated by the Middle Eocene.

LATE QUATERNARY ARCTIC SEDIMENTS AS INDICATORS FOR
DIFFERENT ICE COVERAGE

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Sediment cores from across the Gakkel Ridge (Arctic Ocean) were analyzed by means of radioisotopic age determination and various sedimentological parameters. The sediments consist of siliciclastic material. Due to the high topographic position on the Gakkel Ridge the sediments are of pelagic and ice-rafted origin. All studied sediment cores are quite similar in age,

sediment sequences and other related parameters and thus can easily be correlated across the ridge. Changes in sedimentation rates and sediment material 129 ky ago are clearly related to a rapid climatic change. Recent sediments deposited at the Gakkel Ridge consist of fine-grained ice-rafted material. The recent ice cover in the studied area consists of sea ice which transports such fine-grained material. There is evidence that sea-ice coverage was dominant during the last 129 ky because low sedimentation rates and sediment material were nearly the same during that period. During the ice age which lasted from 186 to 129 ky, coarse-grained material, which was deposited under high-sedimentation rates, suggest dominance of icebergs. The icebergs came from glaciated areas of the Siberian shelves. Various ice-rafted sediments suggest different origin on the shelves. Sedimentation rates from these sediments are highly variable but in parts with more than 10 cm/ky an order of magnitude higher than sedimentation rates determined on sediments which were deposited during the last 129ky. It can be suggested that ice-sheets of the eastern Siberian shelves, in general, did not reach the water line in glacial intervals during the last 129ky.

ANNUAL FLUX OF RADIOLARIA AND OTHER SHELLED PLANKTERS IN THE EASTERN EQUATORIAL ATLANTIC AT 853 m: SEASONAL VARIATIONS AND POLYCYSTINE SPECIES-SPECIFIC RESPONSES

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Shelled microplankters were counted, and polycystine species identified, in 20 time-series sediment trap samples from the eastern equatorial Atlantic (01°47.5'N, 11°07.6'W) at 853 m, between 3/1/89 and 3/16/90. Mean annual flux rates (ind./m/day) were: polycystines: 28,446, tintinnids: 27,275, foraminifers: 17,816, tintinnid cysts: 14,632, phaeodarians: 1370, and molluscs: 1192. These yields are noticeably higher than most previous data from various areas of the world ocean. Only 3% of the polycystines and 30% of the phaeodarians were represented by cells with protoplasm. We anticipate that foraminifer and radiolarian fluxes reflect fairly well their abundances in the plankton, but only 0.1% of the tintinnid loricae reach 900 m intact. With the exception of tintinnid cysts and molluscs, abundances were clearly coupled with total particle flux. It is suggested that tintinnid high reproduction rates are responsible for tightest associations between the output of their loricae and total flux. Fluxes of Foraminifera and Radiolaria, which have longer life spans, are more loosely coupled with total flux, and often show peaks approx. 20-40 days after those of the latter. Molluscs, with life spans of ca. 1 year, do not correlate with total flux. Juvenile *Nassellaria* comprised up to 44% of all polycystine shells (mean: 25%). In total, 187 polycystine taxa were recorded, yet only 6 accounted for >50% of all the individuals identified. Although some species did vary in relative abundance in association with total and polycystine flux rates, changes in assemblage composition were of very minor importance. Radiolarian equitability and the percentages of *Spumellaria* were significantly higher at times of lower polycystine flux, yet the fluctuations involved were also minor.