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OCEANOGRAPHIC ABSTRACTS

PART I

This section contains abstracts for a large portion of the references cited in the bibliography, Part I (page A127). These are arranged alphabetically by authors. Part I comprises those abstracts received in the editorial office during the period 1 - 31 December, 1975.

AAGAARD KNUT and PAUL GREISMAN, 1975. Toward new mass and heat budgets for the Arctic Ocean. *J. geophys. Res.*, 80 (27): 3821-3827.

Recent current measurements are incorporated into new heat and mass budgets for the Arctic Ocean. These budgets demonstrate the overwhelming importance of advection by the West Spitsbergen Current, which in 1971 - 1972 transported $16.3 \times 10^9 \text{ kcal cm}^{-2} \text{ s}^{-1}$ into the Arctic Ocean. Partially on the basis of the heat budget, we suggest that there is a large heat loss to the atmosphere in the southwestern Eurasian basin, in excess of $20 \text{ kcal cm}^{-2} \text{ yr}^{-1}$. Annual mean transport in the West Spitsbergen Current could easily vary by 35% and might constitute a significant perturbation on the Arctic heat budget. The mass budgets point toward the general ineffectiveness of the Arctic Ocean in transforming subsurface water masses, and they also indicate a large shear between the ice and the upper layer of the East Greenland Current.

ALBRIGHT L. J., 1975. The influence of hydrostatic pressure upon biochemical activities of heterotrophic bacteria. *Can. J. Microbiol.*, 21 (9): 1406-1412.

Heterotrophic terrestrial and marine bacterial protein synthetic rates decrease by about 16% of the 1-atm rate for every 100 atm of pressure increment, within the pressure range of 1 to 500 atm. It is proposed that protein synthesis is more severely inhibited by pressure than are other anabolic or catabolic reactions.

ALLEN K. R., 1975. The conservation of marine animals. *Search*, 6 (8): 317-322.

Threats to the survival of marine animal populations arise today from four main causes: damage to their habitats by pollution or coastal engineering, accidental destruction in fisheries operations for a different purpose, destruction as pests, and most importantly, over-exploitation as resources. Biologically efficient management depends on two main principles. The first is to maintain sufficient breeding stock. The second is to ensure that the animals are taken at a size or age which will give the greatest weight of yield. Within a country, management is a matter of legislation and enforcement; for international fisheries on the high seas, concerted action among the nations concerned is essential.

AL-SAAD H. A. and E. A. ARNDT, 1973. Some investigations about the hydrographical situation in the lower reaches of Shatt Al-Arab and the Arabian Gulf. *Wiss. Z. Univ. Rostock*, 22 (10): 1169-1174.

This contribution is a report on the results of hydrographical measurements taken at nine stations in the Shatt al-Arab and the Arabian Gulf (Iraq). Seasonal and daily fluctuations can be observed in the temperature and salinity. Vertical and horizontal salinity and temperature gradients occur in the lower reaches of the Shatt al-Arab. The tidal flow exerts a great influence on the salinity near Fao (Shatt al-Arab).

ANDERSON O. L. and P. C. PERKINS, 1973. A plate tectonics model involving non-laminar asthenospheric flow to account for irregular patterns of magmatism in the southwestern United States. In: *Physics and chemistry of the earth*, (1974) 9: 113-122. L. H. Ahrens, J. B. Dawson, A. R. Duncan and A. J. Erlank, eds., Pergamon Press, Oxford.

In this paper we introduce an extension of plate tectonics theory to account for the irregular patterns of magmatism in the southwestern United States which are otherwise inconsistent with reconstructed Cenozoic events at the Pacific margin. Many authors have pointed out the difficulties in explaining the structural and magmatic histories of the southwestern United States by a conventional plate tectonics model. In a viscous material for which the Reynolds number is very small, the flow streamlines should conform faithfully to lithospheric boundaries. It is therefore difficult to account for the flow of the mantle "first in one direction, and then in another . . ." which Gilluly (1973) postulated in explaining the regional geology. We propose that large irregularities in flow, resembling eddies, existed in the asthenosphere under what is now the southwestern United States in the Cenozoic. The rising material between adjacent eddies, called surges, concentrated volatiles as the source material for kimberlite magmatism in the southwestern United States. We suggest that surges resulted from non-linearity between viscosity and temperature. Our model is based upon the fluid dynamic theory of Grunfest (1963).

ANDREN A. W. and R. C. HARRISS, 1975. Observations on the association between mercury and organic matter dissolved in natural waters. *Geochim. cosmochim. Acta*, 39 (9): 1253-1257.

Dissolved mercury in estuarine waters from the Mississippi Delta and Florida Everglades is associated with dissolved organic matter which has the properties of fulvic matter found in soils. Ultrafiltration of water samples demonstrated that mercury and dissolved organic carbon are selectively enriched in the < 500 molecular size cut-off fraction. A decrease in high molecular weight dissolved organic matter with increasing salinity in the Everglades exerts a partial control on the mercury content of these estuarine waters.

ANGEL M. V. and M. J. R. FASHAM, 1975. Analysis of the vertical and geographic distribution of the abundant species of planktonic ostracods in the north-east Atlantic. *J. mar. biol. Ass. U. K.*, 55 (3): 709-737.

Halocyprid ostracod data has been analysed from a transect of six stations at approximately 10° intervals from 10 - 60°N close to the 20°W meridian in the N. E. Atlantic. Each station included both day and night horizontal tows over 16 depth horizons covering the top 2,000 m of the water column, taken with opening-closing RMT 1 + 8 nets.

Individual stations were analysed by factor analysis to show the vertical stratification and composition of the ostracod communities at each position. Species richness and the degree of community structuring increased with decreasing latitude. Maximum abundance of the halocyprids occurred at 30°N 23°W where there is the greatest physical stability in the water column.

A total of 96 species were identified, although only 63 were either sufficiently abundant or taxonomically sufficiently reliable enough to include in interstation analyses. Geographic communities are described by the factor analyses of the data pooled from all the stations. Factor scores are plotted to give typical distribution patterns, both in depth and in latitude of these species assemblages. The composition of these assemblages was consistent between both day and night samples.

ANTIPOVA T. V., 1975. Preliminary data on specific composition and quantitative distribution of bivalved molluscs in the Barents Sea. (In Russian; English abstract.) *Okeanologia*, 15 (2): 330-332.

The paper is based on the materials on bivalved molluscs collected at 510 stations in 1968 - 1970. The Bivalvia fauna in the Barents Sea, according to preliminary data, amounts to 69 species. The distribution areas of most of them changed, compared to the twenties: enlarged for the cold-water species and narrowed for more warm-water species. The molluscs are most abundant in the southeastern part of the sea.

ANTONOVA N. M., O. S. MOCHALOVA, I. A. NEMIROVSKAYA and M. P. NESTEROVA, 1975. A method for determination of the dispersive capacity of preparations used for removing oil from water surface. (In Russian; English abstract.) *Okeanologia*, 15 (2): 333-337.

A method is proposed for the evaluation of effectiveness of the dispersive (emulsifying) action of chemical products used for removing oil from the surface of water. When using the accelerated method of destroying the arising emulsions in centrifugal field the method enables one to determine the emulsifying efficiency of the used preparations and to define the influence of the infinite dilution by water upon stability of the resultant emulsions of oil in water. The method developed is very simple in action and gives an opportunity to rapidly obtain comparable data both for different dispersion agents and for different oils.

ARCYANA (R. HÉKINIAN, et al.), 1975. Transform fault and rift valley from bathyscaph and diving saucer. *Science*, 190 (4210): 108-116.

(1) The key problem, determining the present surface expression of the plate boundary in a rift valley and a transform fault can now be partly solved. In the rift valley, injection and accretion of crust are most intense in the 1-km-wide axial zone of the inner floor, where there are young emissive centers such as Mont de Vénus, but also occur within at least 1 km on either side of the axial zone with a type structure of horsts and graben partly accompanied by volcanism. The greatest density of active tectonic features is found in the inner floor of the rift valley, but some active extension with little or no accompanying volcanism is maintained over an 8-km-wide zone. A structural setting in which the width of the injection and tectonic zones is similar is found in the Asal graben. Results of dives near the intersection of the rift valley and transform valley suggest that most of the accretion of lithosphere is accomplished within the 1- to 1.5-km-wide axial zone of the inner floor. Precise dating of the basalts sampled in the inner floor would definitively show the pattern of accretion of new crust at this accreting plate boundary. A quantitative estimate of extension will be based on reconstruction of faults.

In the transform valley the presently active transform fault zone is about 1 km wide, but it may have migrated within the 3-km-wide transform domain. The major, south-facing, east-west wall, on the north side of the deepest part of the transform valley, may represent the principal transform displacement zone, but recent tectonic activity is not confined to it and may be spread over a distance of 600 m.

(2) The predicted left-lateral sense of shear motion in transform fault A was verified in the field by observations on deformed sediments in the transform fault zone and by the existence of an emissive tension fracture striking 045°.

(3) Results of the dives indicate that commonly accepted concepts of the geology of transform faults need to be revised. The distribution of scarps within the transform valleys is such that the valleys do not necessarily provide a good section of the oceanic crust. Although the occurrence of ultramafics in transform faults is not explained by our data, we speculate that they may be linked to intrusions along deep vertical faults.

Sections of the uppermost part of the crust can be obtained on the steep, and often large, normal fault scarps that are found on the inward-facing walls of the rift valley. Systematic exploration of such large walls by submersibles may provide a less ambiguous magmatic stratigraphy of the upper part of the ocean crust than near-vertical drill cores in crust where the density of faults, both synthetic and antithetic, may reach one every 50 m.

(4) Direct observations and sampling of hydrothermal emissive fissures and related metalliferous deposits were made in the transform fault zone. The deposits are mainly rich in iron and manganese and depleted in other transition elements. The iron is preferentially located close to the emissive vents.

ARTEMYEV V. E. and A. D. SHCHERBININ, 1975. On the relation between the distribution of dissolved organic carbon and water dynamics. (In Russian; English abstract.) *Okeanologia*, 15 (2): 272-275.

Dissolved organic carbon and salinity were determined in the subtropical convergence area of the south tropical waters of the Indian Ocean. The character of the vertical distribution of dissolved C_{org} , along with salinity, implies sinking processes in the region under study.

ATEMA JELLE and G. D. BURD, 1975. A field study of chemotactic responses of the marine mud snail, *Nassarius obsoletus*. *J. Chem. Ecol.*, 1 (2): 243-251.

Chemotactic responses of the salt marsh mud snail *Nassarius obsoletus* were tested in the field, to the introduction of a crushed conspecific and to the sympatric gastropod *Littorina littorea* and the bivalve *Modiolus demissus*. The snails responded with burial and escape to the conspecific stimulus, with strong attraction and feeding to *M. demissus*, and with attraction and feeding to *L. littorea*. In blank tests, the numbers of snails fluctuated only slightly during half-hour observation periods. An alarm substance appears to be liberated from wounded *N. obsoletus* which causes rapid disappearance of conspecific snails in an area of up to 50 cm radius.

AYALA F. J., J. W. VALENTINE and G. S. ZUMWALT, 1975. An electrophoretic study of the antarctic zooplankton *Euphausia superba*. *Limnol. Oceanogr.*, 20 (4): 635-640.

Genetic variability has been estimated for a large population of the antarctic krill, *Euphausia superba*, by gel electrophoresis. Of 36 loci studies, 21 (58.3%) exhibit allelic variation. An average individual is heterozygous at 5.8% of the loci, a moderately low level of variability when compared to benthic invertebrates. Low to moderately low genetic variabilities are previously recorded from benthic invertebrates in environments with highly seasonal trophic resources, and *E. superba* fits this relationship.

BAILEY R. J., 1975. Sub-Cenozoic geology of the British continental margin (lat. 50°N to 57°N) and the reassembly of the North Atlantic Late Paleozoic supercontinent. *Geology*, 3 (10): 591-594.

Current reconstructions of the Late Paleozoic North Atlantic supercontinent show differences in detail, notably at more northerly latitudes. It is clear that the establishment of such geological "tie lines" demands detailed knowledge of the geologic structure of the outer shelves.

Data from marine geophysical surveys form speculative sub-Cenozoic geology for the continental margin west of the British Isles. The Great Glen fault is confirmed as a potential offshore structural tie line between the Caledonian Appalachian orogens, although its relationship with the Cabot fault of Newfoundland remains equivocal. A convergent structural lineament crossing the Irish margin at about 53°N has no recognized counterpart in the surficial geology of the mainland, but with the Great Glen fault, it serves to delineate the offshore prolongation of the Irish Caledonides, some elements of which show close similarities to the Fleur de Lys Supergroup of Newfoundland. A more tenuous trans-Atlantic tie line involves correlation of an inferred east-trending fault on the Scottish margin at 56°N with the suggested prolongation of the Grenville front across Rockall Bank.

BAKER P. A. and J. N. WEBER, 1975. Coral growth rate: Variation with depth. *Phys. Earth planet. Interiors*, 10 (2): 135-139.

Light and temperature are two of the most important physical factors affecting rates of growth of reef corals. The effect of light has been determined by X-radiographic measurement of long-term growth rates for 89 colonies of the coral *Montastrea annularis* collected over a 27.5-m depth range from St. Croix, U. S. Virgin Islands. These measurements, in conjunction with measurements of skeletal density, have established that *M. annularis* calcifies most rapidly at intermediate depths, and they have confirmed the identification of two distinct populations within this important frame-building species.

BALLARD R. D., W. B. BRYAN, J. R. HEIRTZLER, G. KELLER, J. G. MOORE and Tj. VAN ANDEL, 1975. Manned submersible observations in the FAMOUS area: Mid-Atlantic Ridge. *Science*, 190 (4210): 103-108.

Lava forms resemble those observed on terrestrial pahoehoe lava flows; the features that appear in truncated fault scarps as circular or elliptical pillows are elongated, tubular forms in three dimensions. Detached, subspherical pillows are very rare. The lavas show systematic chemical and mineralogical variation, with the olivine basalts associated with the central volcanic highs and plagioclase-pyroxene basalts being typical of the west and east walls. Active volcanism is mainly restricted to a narrow (0.5 to 1 km wide) central zone in the median valley. The central valley has a horst-like structure which is bounded by graben at the base of the east and west walls. Intrusive sills and dikes are exposed only at the base of one 300-m scarp on the west wall. Most fault displacements are less than 100 m and expose only breccia, truncated lava pillows, and tubes.

In general, faulting appears to be a continuing process, while volcanic activity is episodic. Structural deformation rapidly degrades the primary volcanic morphology typical of the central highs, although volcanic features are locally preserved on the wider structural terraces on the west and east flanks of the median valley. Dives in Fracture Zone B revealed minor deformation of recent sediment cover, but there was no evidence of recent volcanic or hydrothermal activity.

BARCILON A., J. LAU, S. PIACSEK and A. WARN-VARNAS, 1975. Numerical experiments on stratified spin-up. *Geophys. Fluid Dynam.*, 7 (1): 29-42.

Numerical experiments were performed for the spin-up of a stratified Boussinesq fluid in a right cylinder. The so-called "corner jet", postulated in earlier analytical treatments by Walin, is found to have an inclination which oscillates between near-horizontal to near-vertical positions. The net effect is that some of the fluid spends more time in viscous boundary layers before entering the interior than if the jet were inclined at a steady angle to the vertical. This accounts for the shorter experimentally observed spin-up times and for the discrepancy between theory and experiments.

BASOV I. A., 1975. Quantitative distribution of benthonic foraminifers on the north-western African shelf. (In Russian; English abstract.) *Okeanologia*, 15 (2): 325-329.

The studies of 23 sediment samples taken from the northwestern African shelf and the shelf break zone at depths of 25 to 465 m show a direct relation between the distribution of foraminiferal numbers and bottom topography, water dynamics and the concentration in sediment of organic carbon and calcium carbonate. The minimum foraminiferal numbers were found on the inner shelf within the wave action zone to depths of 60 to 70 m in sediments with low concentrations of C_{org} and $CaCO_3$. The foraminiferal numbers were maximal in sediments with high C_{org} and $CaCO_3$ concentrations on the outer steeper part of the shelf within the upwelling zone. The foraminiferal numbers decrease again in the shelf break zone. Planktonic foraminifers increase in number gradually from the coastline towards the outer margin of the shelf.

BAXTER A. N., 1975. Petrology of the Older Series lavas from Mauritius, Indian Ocean. *Geol. Soc. Am. Bull.*, 86 (10): 1449-1458.

The Older Series volcanics of Mauritius form a widely differentiated transitional basalt suite, in which two distinct stages of activity can be recognized. The first stage, shield-building, is composed principally of alternating picrite-basalt flows and agglomerate; this is followed by a second, evolved stage composed of feldsparphyric basalt, hawaiite, mugearite, and high-level trachytic intrusive rocks.

Three suites of nodules, each with specific associations, occur in the volcanic rocks; these are probably derived from layered subvolcanic cumulates. The nodular suites are: (a) dunite and wehrlite (restricted to the picrite basalt), (b) Bytownitic anorthosite (found only in the feldsparphyric basalt), and (c) mafic syenite (exclusive to the trachytic intrusive rocks). There is some evidence, from the extremely calcic nature of the plagioclase in the anorthosite nodules and feldsparphyric basalt and from the presence of kaersutite in evolved lava, that a hydrous period of crystallization developed, probably in the later stages of activity.

Variation diagrams indicate clearly the close control of phenocryst mineralogy on bulk-lava chemistry, compositions with more than 5 or 6 percent MgO lying along a pronounced olivine + clinopyroxene control line and more evolved lava along a trend developed from fractionation of olivine + clinopyroxene + plagioclase + titanomagnetite. Trachytic compositions show pronounced trace-element trends, probably controlled by anorthoclase fractionation, but it can be demonstrated that they are unlikely to represent successive differentiates from a common trachytic magma. A distinct "silica gap" within the series, reflected in the absence of benmoreite, is tentatively ascribed to secondary boiling phenomena.

BAXTER LINCOLN II and C. Y. YANG, 1975. Fluctuations of narrow-band sound amplitudes from long-range transmissions in the deep Atlantic Ocean. *J. acoust. Soc. Am.*, 58 (3): 595-603.

For transmission paths between a fixed acoustic source at 527-m depth near Eleuthera and a fixed receiver at 1723 m near Bermuda, G. E. Stanford showed that the spectrum of fluctuations in acoustic intensity is nearly flat up to 3 cycles/h and drops off as $1/f^3$ above this frequency. For comparison with internal gravity wave disturbances of the sound velocity profile, we analyzed amplitude fluctuations of transmissions from floats deployed as part of the 1973 series of Mid-Ocean Dynamics Experiments (MODE). These floats, carrying 30-W input, 270-Hz sound sources pulsed for 1.67 sec at 3-min intervals, drifted near 28°N, 70°W at a depth of approximately 1,500 m. The transmissions were received by fixed hydrophones (MILS system), located on the sound channel axis on the slopes of Eleuthera and Grand Turk. We found a spectrum similar to Stanford's, except that the $1/f^3$ characteristic begins at 1 cycle/h. For each experiment, this rolloff frequency coincided approximately with the Brunt-Väisälä frequency at the turning points of those SOFAR paths with minimum excursion from the axis.

BEA R. G., 1975. Gulf of Mexico hurricane wave heights. *J. Petrol. Tech.*, Sept 1975: 1160-1172.

Measurements of deep-water wave heights and winds generated by hurricanes in the Gulf of Mexico and inferred wave heights have been used to calibrate a hindcast model and to characterize its reliability. The model has been applied in a hindcast of deep-water maximum sea states generated by hurricanes that affected the area from 1900 through 1969.

BELYAEV V. I., A. I. LENIN and T. S. PETIPA, 1975. Mathematical model of a pelagic ecosystem. *Mar. Biol.*, 31 (1): 1-6.

A mathematical model is presented of the ecosystem in the upper layers of the marine pelagic zone. The model has been constructed on the basis of presumed connections between biotic and abiotic ecosystem parameters typical of the Black Sea. The model is characterized by a rather complex behaviour. Realization of the model on the electronic computer is made using random trajectories. As a result, a qualitative picture of model behaviour under different conditions is revealed and statistical characteristics of the parameters are obtained.

BELYAEV V. S., I. D. LOZOVATSKY and R. V. OZMIDOV, 1975. On the relationships between small-scale turbulence parameters and local background conditions in the ocean. (In Russian; English abstract.) *Fiz. Atmosf. Okeana, Izv. Akad. Nauk, SSSR*, 11 (7): 718-725.

The results of measurements of small-scale turbulence and local temperature field on a polygon during the 7th cruise of the research vessel *Dmitry Mendeleev* are analysed. The dependence of the current velocity fluctuation variance on the local values of the Richardson number may be approximated by a hyperbola. A particular case of strongly intermittent fluctuating velocity field probably caused by the breaking of hydrodynamically unstable internal waves is also analysed. The turbulence spectra in this case agree rather well with those obtained in laboratory experiments at Reynolds numbers of order 10^4 .

BENON PATRICIA, FRANÇOIS BLANC, BRIGITTE BOURGADE, ROGER KANTIN, PIERRE KERAMBRUN, MICHEL LEVEAU and DOMINIQUE SAUTRIOT, 1975. Essai d'écotypologie protéique au niveau du sous-écosystème zooplanctonique d'une aire maritime polluée (Golfe de Fos). *C. r. hebd. Séanc. Acad. Sci., Paris, (D)* 281 (4): 235-238.

Correspondence analysis applied to the study of esterases of 32 zooplankton samples from the Gulf of Fos shows a geographic distribution. This cannot be connected to the distribution of zooplanktonic species and suggests there may be some physiological differences which are probably related to local ecological conditions.

BERGGREN W. A. and JANE AUBERT, 1975. Paleocene benthonic foraminiferal biostratigraphy, paleobiogeography and paleoecology of Atlantic-Tethyan regions: Midway-type fauna. *Palaeogeogr. Palaeoclimatol. Palaeoecol.*, 18 (2): 73-192.

The stratigraphic, geographic and bathymetric distribution of some Paleocene benthonic foraminiferal assemblages have been studied in the Tethyan and circum-Atlantic regions within the framework of planktonic foraminiferal zones. Although some species appear to be restricted to either the Tethyan-European area or to the western Atlantic, the majority of species are ampho-Atlantic and Tethyan in distribution. The cosmopolitan distribution is attributed to more equitable climatic conditions (low polar-equatorial thermal gradient) and warmer, more uniform thermal structure of the oceans and different paleogeographic and paleo-oceanographic conditions.

Two main distinct depth-controlled benthonic foraminiferal assemblages (exclusive of the shallow-warm water Tethyan carbonate assemblage) have been recognized in the Paleocene. The continental shelf fauna, termed here the "Midway-type fauna" (MF) is characterized by species of *Cibicidoides alleni* (Plummer) = *propria* Brotzen, *howelli* (Toulmin), *succedens* (Brotzen), *Anomalinoïdes acuta* (Plummer), *midwayensis* (Plummer)], *Gavelinella [danica* (Brotzen), *neelyi* (Jennings)], and *Osangularia plummerae* Brotzen, as well as various lagenids (nodosariids, lenticulinids, vaginulinids), polymorphinids and textulariids. A lower continental slope and abyssal plain fauna, termed here the "Velasco-type fauna" (VF), is characterized by, amongst others, *Gavelinella [beccariiiformis* (White), *rubiginosa* (Cushman), *velascoensis* (Cushman)], *Nuttallides truempy* (Nuttall), *Nuttallinella florealis* (White), *Osangularia velascoensis* (Cushman), *Aragonia velascoensis* (Cushman), nodosariids (*N. velascoensis* Cushman, *Dentalina limbata* d'Orbigny), various agglutinated forms [*Gaudryina pyramidata* Cushman, *Tritaxia aspera* (Cushman), *Dorothia* ex. gr. *oxycoona trinitatis* (Cushman and Renz)], and various gyrogonidins and buliminids. Pleurostomellids and stilostomellids are quantitatively rare and unimportant until the Middle-Late Eocene.

This paper discusses the biostratigraphy and biogeography of the "Midway-type fauna". A companion paper, being prepared by a colleague, R. C. Tjalsma, will treat the "Velasco-type fauna". The upper continental slope has not been studied in sufficient detail at the present time, but we expect in this area a mingling of both types of assemblage to occur.

BLANC FRANÇOIS, MICHEL LEVEAU et M.-C. BONIN, 1975. Écosystème planctonique. Structure et fonctionnement en relation avec des phénomènes de dystrophie (Golfe de Fos). *Int. Rev. ges. Hydrobiol.*, 60 (3): 359-378.

In the areas studied, an unusual structure and dynamic behaviour was exhibited by the plankton ecosystems, due for the most part to industrial and natural effluents from the Rhône and Durance. The ecosystem was kept at a low state of maturity, which is characterized by frequent periods of intense multiplication by small species with high metabolic rates, such as the diatom *Skeletonema costatum* and the dinoflagellates *Exuviaella* and *Proocentrum*. Brackish water seems congenial to that type of proliferation.

The turnover rate of the populations decreases as they become older and cell size increases. A lack of competition by species of the same genus is a characteristic of the photoautotrophic organisms in these environments. Secondary production follows the same cycle as the primary production by the dinoflagellate population. Zooplankton species of the genus *Acartia* have periods of intensive development in these areas.

BLANTON J. O., 1975. Potential energy fluctuations at the edge of the North Carolina continental shelf. *Deep-Sea Res.*, 22 (8): 559-563.

The available potential energy over one month near the continental shelf edge does not slowly decrease during a period of strong surface heating. This indicates that an influx of cold dense water from depth is required to hold it constant. Variations in available potential energy near the continental shelf edge appear sufficiently great to be a source for the observed eddy flux of momentum to the mean flow.

BOGDANOV K. T. and B. V. KHARKOV, 1975. Computation of tides in the Indian Ocean. (In Russian; English abstract.) *Okeanologiya*, 15 (2): 227-232.

The new tidal charts of the wave components M_2 , S_2 , K_1 and O_1 and the chart showing the character of tides for the whole Indian Ocean are presented. The charts are based on the data of the solution of the differential tide equations, i.e., the first boundary-value problem. The correctness and the accuracy of the tidal charts were verified through the precomputation of the actual and the theoretical values of the tidal harmonic constants on the Indian Ocean islands. The basic features are considered of tidal oscillations of the sea-level in the Indian Ocean.

BOLTOVSKOY DEMETRIO, 1975. Ecological aspects of zooplankton (Foraminifera, Pteropoda and Chaetognatha) of the southwestern Atlantic Ocean. *Veliger*, 18 (2): 203-216.

Some pteropod species (*Limacina helicina*) and Chaetognatha (*Eukrohnia hamata*, *Sagitta serratodentata* and *S. tasmanica*) of the southwestern Atlantic present differences and/or morphological variations with respect to the specimens described previously.

The Chaetognatha as well as the Pteropoda in the studied zone, have daily vertical migratons. Foraminifera lack them. From the faunistic point of view the 0 - 50 m interval is very homogeneous in the studied area. The Chaetognatha populations occupy both during the day and the night the subsurface layer and their daily vertical migrations affect the 0 - 50 m interval very little.

There exists a positive but low correlation among the specific distributions of the studied groups and the surface temperature of the water. There exist in the southwestern Atlantic interspecific groups of associated species of Foraminifera, Pteropoda and Chaetognatha and numerous species associated with them. All these species can be ordered according to their affinity to warm or cold waters. These groups of species are different from those found by other authors who worked with material from other zones.

There is a considerable coincidence between Foraminifera, Pteropoda and Chaetognatha as to the horizontal distribution of their indicator species. In general terms, to obtain a representative sample of the Chaetognatha of a certain area, it should be larger than that needed for Pteropoda and the one needed for the latter larger than that analogous for Foraminifera. Foraminifera are, in the sampled area, better hydrological indicators than the other two taxa. Using the index of similarity between samples in the work area, 4 different faunistic zones can be determined: subtropical, subtropical-subantarctic with subtropical dominance, subtropical-subantarctic with subantarctic dominance and purely subantarctic.

The hydrological results obtained in this work coincide with those that were previously obtained based on the study of Foraminifera. Probably the eastern limit of the Malvinas current should be located somewhat to the east of what has been established based on the Foraminifera-indicators. Probably there exist, in the ample and unstable convergence zone, certain areas with regularly cyclic or simply stable characteristics, isolated from the principal mass of water which surrounds them.

BREKHOVSKIKH L. M., V. V. GONCHAROV, V. M. KURTEPOV and K. A. NAUGOLNYKH, 1975. On interaction between the internal and the surface waves in the ocean. (In Russian; English abstract.) *Okeanologiya*, 15 (2): 205-212.

A spectral method is proposed for a numerical solution of the problems of interaction between the surface and the internal waves in the ocean. The obtained spectral form of the equations of hydrodynamics is shown to be advantageous for the use of the asymptotic methods of solution and numerical counting. Stability of three-wave interactions between the surface and the internal waves is studied.

BRENNER MICHAEL, 1975. The Intergovernmental Oceanographic Commission and the Stockholm Conference: a case of institutional non-adaptation. *Int. Orgn.*, 29 (3): 771-803.

This article considers how an established international organization with responsibility for programs of pure and applied science adapts its organizational format and purposes to newly defined tasks. It examines the institutional response of IOC (the Intergovernmental Oceanographic Commission) to the specification of new obligations in the environmental field as stipulated by the United Nations Conference on the Human Environment, and as developed by the Environmental Program that the Conference established. Its main theme is the place of specialized knowledge, and the role of experts at the various stages of policy formation, within national governments and international forums. In analyzing the adaptation of IOC through expert and non-expert activities, our aim is to determine whether new programs and initiatives are fitted to the existing framework, or produce new structures and institutional arrangements.

BRISCOE M. G., 1975. Preliminary results from the trimoored Internal Wave Experiment (IWEX). *J. geophys. Res.*, 80 (27): 3872-3884.

A three-dimensional array of 20 current meters, temperature sensors, and vertical temperature gradient sensors was successfully deployed for 40 days in late 1973 in the main thermocline over the Hatteras Abyssal Plain southeast of Bermuda. Sensor spacings in the main array were 1.4 - 1,600 m in the horizontal, 2.1 - 1,447 m in the vertical. The minimum sampling interval was 225 s. The ultimate purpose of the experiment was to estimate a vector wave number-frequency spectrum of internal waves without the usual assumptions of simple modal structure, horizontal isotropy, and linearity. The purpose of this paper is to describe some of the early results. Autospectra from the array normalize quite well in depth according to the WKBJ 'high-mode' solutions. Spectra of vertical displacements show a significant contribution from the internal semidiurnal tide. Samples of 1,760 cross spectra calculated, based on a 40-day averaging interval, suggest horizontal isotropy, vertical homogeneity, and a possible degradation of current coherences because of fine structure in the velocity profile. Coherence of vertical displacements, i.e., temperature fluctuations for measurements separated horizontally decays with increasing separation according to $f_{1/2} X = 330 \text{ m} \cdot \text{cph}$, where $f_{1/2}$ (cph) is the frequency at which the coherence falls to one half and X (m) is the horizontal separation. This empirical rule is based on $1,600 \text{ m} > X > 140 \text{ m}$; for smaller X , $f_{1/2}$ exceeds the local buoyancy frequency. Autospectra and cross spectra of vertical displacements sometimes show peaks at frequencies just less than the local buoyancy frequency; current spectra do not show such peaks. Inverse modeling of the internal wave field is in progress; expected results are a vector wave number-frequency spectrum and a description in parameter space that hopefully will permit future experiments to be less elaborate.

BROWN C. M., D. S. MACDONALD-BROWN and S. O. STANLEY, 1975. Inorganic nitrogen metabolism in marine bacteria: nitrate uptake and reduction in a marine pseudomonad. *Mar. Biol.*, 31 (1): 7-13.

Growth experiments in batch cultures indicated that the uptake of nitrate by the marine pseudomonad PL1 was inhibited in the presence of ammonia provided that the ammonia concentration was higher than 1 mM. At ammonia concentrations of less than about 1 mM, however, both nitrate and ammonia were utilised simultaneously. The saturation constants for nitrate and ammonia uptake were both $2.6 \times 10^{-4} \text{ M}$, and similar to the Michaelis constants of nitrate reductase for nitrate ($2.9 \times 10^{-4} \text{ M}$) and glutamine synthetase for ammonia ($2 \times 10^{-4} \text{ M}$). Nitrate reductase activity linked to NADH was detected in chemostat-grown cultures with nitrate as nitrogen source, and in cultures containing limiting concentrations of nitrate and ammonia, ammonia or glutamate. Enzyme synthesis appeared to be repressed in cultures containing an excess of ammonia or glutamate. Chemostat cultures utilised ammonia or glutamate in preference to nitrate, while there was no marked preference between ammonia and glutamate.

BROWN D. M., 1975. Four biological samplers: opening-closing midwater trawl, closing vertical tow net, pressure fish trap, free vehicle drop camera. *Deep-Sea Res.*, 22 (8): 565-567.

Four systems for sampling marine organisms have been developed. A system has been designed to convert an Isaacs-Kidd midwater trawl into an opening-closing net. A closing vertically towed net was built to reduce the handling and scaring problems of this style of sampling. A trap has been designed to capture live fish at great depths and hold them in their own cold water and keep them under pressure. A low-cost free vehicle drop camera system has been developed to photograph schools of fish detected on sonar, providing a simplified method of identifying pelagic fish stocks.

BROWN MURRAY, 1975. High molecular-weight material in Baltic seawater. *Mar. Chem.*, 3 (3): 253-258.

The concentration of high molecular-weight material ($> 10,000$), HMWM, in Baltic water was estimated by Amicon membrane ultra-filtration, followed by transmission spectroscopy of the concentrate. In most cases, the HMWM accounted for about 1% of the dissolved organic matter as estimated by absorption measurements at 280 nm. A loss of HMWM with increasing salinity is indicated.

BROWN SEYOM and L. L. FABIAN, 1975. Toward mutual accountability in the nonterrestrial realms. *Int. Orgn.*, 29 (3): 877-892.

The inherited international regimes for the ocean, outer space, and the weather—based largely on the principles of open access and free use—are inappropriate to the emerging needs in these realms for efficient and equitable allocation of resources and for conflict management. Neither a substantially greater exercise by national governments of management authority, nor a marginalist approach to increasing the authority of functionally-specific international institutions will suffice. A major commitment to expand and strengthen processes of international accountability among the users of these realms is required. Institutional targets for the mid-1980s should include a comprehensive ocean authority; an outer space projects agency; a global weather and climate organization; and an international scientific commission on global resources and ecologies. Transitional strategies, of a marginal and functionally-specific nature, however, will be required in the meantime, directed toward internationalizing information on the nonterrestrial realms, drawing the relevant actors into consultative arrangements, and limiting current unilateralist trends.

BUDD W. F., 1975. Antarctic sea-ice variations from satellite sensing in relation to climate. *J. Glaciol.*, 15 (73): 417-426.

An analysis of records of annual mean temperatures around Antarctica shows large-scale anomalies of thousands of kilometers extent with typical variations of 2° from one year to another. From 1967 on, composite satellite photographs are available which show considerable variation in the sea-ice extent in different years up to about 5° of latitude. These largest differences seem to persist over entire seasons. In general there seems to be considerable association between the region around the Antarctic with the coldest temperatures and the regions of greatest sea-ice extent. An analysis of long-term records at a single location near the edge of the Antarctic sea ice indicates a strong correlation between variations in the annual mean temperature and the duration of the sea ice, such that a change of 1° in the annual mean temperature corresponds to about 70 d variation in the duration of the sea ice. A relation is obtained between variations of annual mean temperature and the mean extent of the sea ice, viz. a 1° change corresponds to approximately 2.5° lat variation in the maximum sea ice extent. The magnitude of the variations in the sea-ice extent observed from the satellite data in comparison with the large-scale temperature anomalies is compatible with the above relations, although some rotational shifts appear to take place.

CAHET GUY, 1974. Transfert d'énergie en milieu sédimentaire. Cas des sulfatoréducteurs. I. Les acides organiques en sédiments lagunaires et marins (Golfe du Lion). *Vie Milieu*, (B) 24 (2): 235-256.

In the Mediterranean margino-littoral sediments of the Golfe du Lion, the temporal variations of organic acids depend upon their binding to deposit particles.

Consistently a great part of the organic acid reserve is found in the fraction that is most strongly bound to the sediment. The ratios of the different fractions happen to have characteristic mean values. In lagoons, these compounds suggest a possible heterotrophic action. In early diagenesis, glucides that are easily assimilated disappear rapidly. From a biological viewpoint, this emphasizes the importance of the role of organic acids; but the amounts present do not account for the action of the sulfate reducing heterotrophs present. These microflorae must possess some metabiotic adaptations for their development.

CARTER LIONEL, 1975. Sedimentation on the continental terrace around New Zealand: A review. *Mar. Geol.*, 19 (4): 209-237.

The New Zealand continental terrace is mantled mainly by terrigenous and biogenic sediments associated with subordinate but locally important authigenic, volcanogenic and residual components. Modern terrigenous sands and muds prevail off Westland and Hawkes Bay—Wairarapa where tectonically rising landmasses, several major rivers and few coastal sediment traps ensure deliverance of much sediment to the terrace. Relict terrigenous sands and gravels typically occur in zones where modern sedimentation is low like the middle and outer continental shelf off Otago—Canterbury and Waikato—Taranaki. Relict sediments are commonly associated with biogenic sands and gravels which also dominate the terrigenous-starved shelves around northernmost and southernmost New Zealand, and much of the continental slope. Shelf biogenic components are mainly molluscan, bryozoan and foraminiferal clasts, whereas on the slope foraminifers and calcareous nannoplankton prevail. Both glauconite, the main authigenic component, and residual sediments occur on those shelves and upper slopes receiving little modern terrigenous sediment. Volcanogenic grains are prominent in sediments on the eastern terrace marginal to the Central Volcanic Region of the North Island.

Typically, terrigenous shelf sediments off the North Island and northeast South Island have been reworked from older sediments or derived directly from volcanic rocks or both. Around the remainder of the South Island a metamorphic and plutonic-derived assemblage prevails. Sediment dispersal is along the shelf primarily under the influence of storm-driven and tidal currents with semi-permanent ocean currents having little effect. Beyond the shelf, dispersal appears to be mainly downslope, partly through redepositional mechanisms including gravity slumps and turbidity currents.

CARTWRIGHT D. E., 1975. A subharmonic lunar tide in the seas off Western Europe. *Nature, Lond.*, 257 (5524): 277-280.

A small and often neglected tidal component, which is an exact subharmonic of the M_2 tide, is shown to have unusually large amplitudes over a sea area stretching from Shetland to the Azores, including the North Sea. An explanation is offered in terms of normal oceanic modes recently computed by Platzman, and implications for tidal prediction procedures are discussed.

CAVIEDES C. N., 1975. El Niño 1972: its climatic, ecological, human, and economic implications. *Geogr. Rev.*, 65 (4): 493-509.

In 1972 northern Peru experienced an El Niño exceeded in this century only by one in 1925. Warm water from the equatorial Pacific invaded the northern sector of the weakened Peru Current, upsetting the ecological equilibrium and reducing the number of anchovies. The Peruvian fishing industry experienced the worst crisis since its inception in the early 1950's; that crisis culminated in its nationalization. The oceanic El Niño was accompanied by torrential rains between the Tumbes and Zaña river valleys, which caused high peak flows and floods in ephemeral streams. The natural pastures that developed in the Piura Valley provided temporary grazing for cattle brought in from Argentina and Honduras. The severity of the 1972 El Niño derived from abnormal conditions of the atmospheric and oceanic circulation in the tropical and subtropical Pacific. Teleconnections between precipitation anomalies and wind-pattern changes in the tropical Atlantic and northern Pacific suggest furthermore, that the El Niño is linked to major alterations in the general circulation of the atmosphere.

CHARDY PIERRE, 1974. Deux espèces nouvelles d'Isopodes Asellotes récoltées en Méditerranée profonde. *Vie Milieu*, (B) 24 (2): 409-420.

Two new species of Asellota Isopoda of the Mediterranean deep-sea fauna are described in this article: *Pseudomesus bispinosus* sp. n. collected from the western Mediterranean abyssal plain, and *Ilyarachna medorientalis* sp. n. collected from the Matapan trench and the Aegean sea. The genus *Pseudomesus* is new for the Mediterranean. The great vertical distribution of *I. medorientalis* sp. n. is in accord with the eurybathic nature of Mediterranean benthic deep-sea species.

CLARK R. C. Jr. and J. S. FINLEY, 1975. Uptake and loss of petroleum hydrocarbons by the mussel, *Mytilus edulis*, in laboratory experiments. *Fish. Bull., Nat. mar. Fish. Serv., U. S.*, 73 (3): 508-515.

Petroleum paraffin hydrocarbons ($n\text{-C}_{14}\text{H}_{30}$ to $n\text{-C}_{37}\text{H}_{76}$) from No. 2 and No. 5 fuel oils were rapidly incorporated into the mussel, *Mytilus edulis*, in a laboratory system that simulated tides. The mussels were exposed to levels of petroleum hydrocarbons from a surface slick similar to those encountered in the environment after an oil spill. After 14 days in clean seawater, the mussels had lost most of the hydrocarbons from the fuel oils; however, detectable traces of the No. 2 fuel oil still remained after 35 days. Preliminary results from these laboratory studies confirm previous studies of pollutant uptake and loss following actual oil spills.

CONROY J. W. H., M. G. WHITE, J. R. FURSE and G. BRUCE, 1975. Observations on the breeding biology of the chinstrap penguin, *Pygoscelis antarctica*, at Elephant Island, South Shetland Islands. *Br. Antarct. Surv. Bull.*, 40: 23-32.

Breeding chinstrap penguins, *Pygoscelis antarctica*, made two foraging trips per pair per day during the early chick stage. This, and other observations on the breeding biology of the chinstrap penguins made by members of the Joint Services Expedition to Elephant Island (1970-71), are presented and compared with the data on chinstrap, Adélie (*P. adeliae*) and gentoo (*P. papua*) penguins from other breeding localities. Adaptive radiation to reduce competition for food is discussed; it is suggested that the Adélie and chinstrap penguins may feed in different marine regions during the breeding season.

COSLETT P. H., M. GUYATT and R. H. THOMAS, 1975. Optical levelling across an antarctic ice shelf. *Br. Antarct. Surv. Bull.*, 40: 55-63.

A 66 km optical levelling profile was measured approximately along a flow line from the inland ice sheet to the ice front. A second profile 69 km in length was measured across the direction of flow. The flow-line profile was re-levelled after an interval of 3 years to test whether the ice shelf was in steady state. There were no significant changes and it was concluded that an interval of at least 10 years would be required to smooth out random short-term fluctuations in surface level.

CRAPPER P. F., 1975. Measurements across a diffusive interface. *Deep-Sea Res.*, 22 (8): 537-545.

The transports of heat and salt across a density interface between two layers of liquid were measured in the laboratory. The interface was stabilized by a density difference, $\beta\Delta S$, produced by a salinity contrast, and destabilized by a density difference, $\alpha\Delta T$, produced by a temperature contrast. The fluxes were measured as functions of the density ratio $\beta\Delta S/\alpha\Delta T$ over the range $1 < \beta\Delta S/\alpha\Delta T \leq 10$, using two different techniques. The instantaneous thickness of the interface was also measured over the range $1 < \beta\Delta S/\alpha\Delta T \leq 4$. Two distinct but overlapping mechanisms are effective: double-diffusive convection and mechanical mixing.

CRONAN D. S., 1975. Manganese nodules and other ferro-manganese oxide deposits from the Atlantic Ocean. *J. geophys. Res.*, 80 (27): 3831-3837.

Atlantic manganese nodules and encrustations are most abundant in areas of slow sedimentation beneath the carbonate compensation depth or where currents inhibit sediment accumulation. They principally contain the minerals todorokite and δMnO_2 , which are selectively concentrated into nodules and encrustations, respectively, and which show an environmental differentiation thought to be related to redox potentials. Excluding the continental margins, todorokite is most abundant in deepwater deposits. Mineralogical differences between nodules influence their chemical compositions, Ni and Cu being most abundant in samples rich in todorokite and Co in those rich in δMnO_2 . Chemically, the deposits differ from those in other major oceans principally in their higher Fe and lower Ni and Cu contents, which may be due to higher rates of supply of Fe to the deposits than those in the other oceans. Regional variations occur in the concentrations of several elements, Mn, Ni, and Cu being enriched in deepwater deposits from areas of slow sedimentation between the Mid-Atlantic Ridge and the continental margins and Co being enriched in some deposits from elevated localities. These variations are thought to be due to variation in the sources of the elements concerned and in the depositional environment.

CROW S. A., D. G. AHEARN, W. L. COOK and A. W. BOURQUIN, 1975. Densities of bacteria and fungi in coastal surface films as determined by a membrane-adsorption procedure. *Limnol. Oceanogr.*, 20 (4): 644-646.

A membrane-adsorption technique for counting surface slick microbial populations was evaluated. The simple procedure gave bacterial and fungal populations several orders of magnitude greater than those previously reported for surface slicks.

CUNNINGHAM P. A. and M. R. TRIPP, 1975. Factors affecting the accumulation and removal of mercury from tissues of the American oyster *Crassostrea virginica*. *Mar. Biol.*, 31 (4): 311-319.

Adult oysters, *Crassostrea virginica* (Gmelin) were held in seawater containing 10 or 100 ppb mercury in the form of mercuric acetate for 45 days. Mercury concentration in tissues was determined by analysis of individually homogenized oyster meats using wet digestion and flameless absorption spectrophotometry. After 45 days, average mercury tissue concentration was 91,600 and 12,100 ppb in the 100 and 10 ppb mercury groups, respectively. A slight decline in mercury residues in the 100 ppb group during the accumulation period was attributed to spawning. Clearance of mercury from tissues was studied in a constant temperature regime $25^{\circ}\text{C} \pm 2^{\circ}\text{C}$ for 25 days and in a declining temperature regime, 25° to 5°C , for 80 days by exposing treated adults to estuarine water with no mercury added. The biological half-life of mercuric acetate was 16.8 and 9.3 days in the 25°C temperature regime, and 35.4 and 19.9 days in the declining temperature regime, for the 10 and 100 ppb groups, respectively. Smaller oysters, 0 to 7 g, consistently accumulated more mercury per gram wet weight than larger oysters, 7 to 20 g, in populations exposed to 10 and 100 ppb mercury.

DALRYMPLE G. B., R. D. JARRARD and D. A. CLAGUE, 1975. K-Ar ages of some volcanic rocks from the Cook and Austral islands. *Geol. Soc. Am. Bull.*, 86 (10): 1463-1467.

K-Ar age measurements on 19 volcanic rocks from Rurutu, Mangaia, Rarotonga, and Aitutaki in the Cook-Austral chain do not show a systematic increase in the age of the volcanoes to the west-northwest away from Macdonald Seamount as predicted by the melting-spot hypothesis and suggested by geomorphic evidence. Ages determined for alkalic basalt samples from Rurutu range from 1.02 to 1.09 m y, for Mangaia from 16.6 to 18.9 m y, and for Aitutaki from 0.66 to 0.77 m y. Two distinct periods of volcanism on Rarotonga were dated at 1.8 and 1.2 m y B. P. The relation between the dated units and the main shield-building stage of these volcanoes is uncertain and will remain so until better data on the eruption history and mode of formation of volcanoes in the chain are available.

DARRACOTT ANN and HELEN WATLING, 1975. The use of molluscs to monitor cadmium levels in estuaries and coastal marine environments. *Trans. roy. Soc. S. Afr.*, 41 (4): 325-338.

Molluscs are known to accumulate cadmium, an element toxic to man, to levels in excess of those commonly found in marine waters. It is shown that molluscs can be used to monitor cadmium levels in estuarine and other marine environments. The reliability of this type of monitoring is compared with data obtained from standard sediment and water sampling surveys, using as an example studies in two estuaries in the United Kingdom. Cadmium concentrations in the Pacific oyster *Crassostrea gigas* from these estuaries are quoted, together with concentrations in molluscs from other polluted and unpolluted environments. Suggestions are made as to which of the variety of molluscs occurring around the South African coast might be most useful as monitoring organisms.

DAVIES J. M., 1975. Energy flow through the benthos in a Scottish sea loch. *Mar. Biol.*, 31 (4): 353-362.

Analysis of material collected in settlement traps at regular intervals over a period of a year gave an estimate of the annual organic input to the bottom sediment of about 28 g C/m^2 year, which is a little less than one third of the primary production in the overlying water column. The aerobic benthic community metabolism, estimated from *in situ* respiration measurements, was not significantly different from the carbon input. The rate of release of ammonia from the sediment was also measured *in situ* and would be sufficient to supply the greater part of the required input of inorganic nitrogen for photosynthesis in the water column.

DE BOER JELLE, 1975. Variations of the magnetic properties of postglacial pillow lavas along the Reykjanes Ridge. *J. geophys. Res.*, 80 (26): 3769-3776.

Systematic rare earth and minor element concentration variations occur in postglacial tholeiites which were extruded along the axial zone of the Reykjanes Ridge. The northward increase in total Fe and Ti is partly responsible for an increase in the peak magnetic intensity of the lava flows between 60°N and $62^{\circ}45'\text{N}$. Three pillow lava types can be distinguished magnetically: high-remnance lavas which coagulated into small pillows, intermediate-remnance lavas, and low-remnance lavas which are made up of large pillows. From approximately $62^{\circ}45'$ latitude northward the peak magnetic intensity of the different pillow lava types decreases, despite a continued increase of the magnetic mineral content (as suggested by a further increase in total Fe and Ti). This can be explained by oxidation of the titanomagnetite, due to an increase in the degree of degassing and H_2O dissociation of the tholeiites emplaced at a depth less than 400 m. Magnetic anomaly amplitudes over the axial zone of the ridge increase between 60°N and $62^{\circ}45'\text{N}$ and decrease from the latter latitude northward. The amplitude pattern therefore closely resembles that obtained for the peak intensity variations of the tholeiites. This suggests that the 'telechemical' hypothesis may be basically correct.

DEN HARTOG C., ed., 1975. Seagrasses: Responses to ecological factors, community structure and dynamics. [Special issue.] *Aquat. Bot.*, 1 (2): 93-215.

From October 22nd to 26th, 1973 an International Seagrass Workshop was held at Leyden, The Netherlands, under the auspices of the Office for the International Decade of Ocean Exploration of the National Science Foundation, Washington, D. C., U. S. A. The results of this workshop are laid down in two publications: (1) *Seagrass ecosystems, recommendations for research programs*. A survey is given of the various problems which are encountered by the study of seagrass ecosystems; a large number of recommendations

for further research, and other desiderata are clearly defined. (2) *Seagrass ecosystems, a scientific perspective*, edited by C. P. McRoy and C. Helfferich, which will appear in the course of this year. It contains the chairmen's reviews on various aspects in the ecology of seagrass ecosystems, e. g. productivity, community structure, decomposition, consumer ecology, and the abiotic environment.

Several of the participants had data at their disposal, which could not be incorporated in the latter book. It was decided to invite them and other scientists to prepare a contribution for a special seagrass issue of *Aquaculture* which would contain papers on transplant experiments, productivity and consumer ecology. The remaining papers which deal with responses to ecological factors, community structure and dynamics, and decline of seagrass communities, together form the present issue of *Aquatic Botany*.

DEN HARTOG C. and P. J. G. POLDERMAN, 1975. Changes in the seagrass populations of the Dutch Waddenzee. *Aquat. Bot.*, 1 (2): 141-147.

A survey is given of the changes in the seagrass populations in the Dutch Waddenzee. A comparison of maps of the distribution in 1869 and 1930 shows that considerable changes took place before the "wasting disease" destroyed the sublittoral *Zostera marina* populations in the Waddenzee. These changes have to be regarded as normal long-term fluctuations within the large-scale pattern of the dynamic equilibrium of the Waddenzee ecosystem. In 1932 the "wasting disease" reached The Netherlands. The eulittoral populations of *Z. marina* did not succumb to it, while the eulittoral *Z. noltii* was not affected at all. In the period between 1932 and 1965 some quantitative fluctuations were noticed in the eulittoral populations of *Z. marina* and *Z. noltii*. After 1965 a general decline of both *Zostera* species commenced and is still in progress. This decline is no doubt a consequence of the increasing pollution, but the responsible factor has not been ascertained beyond doubt.

DONGUY J. R. and C. HENIN, 1975. Surface waters in the north of the Coral Sea. *Aust. J. mar. Freshwat. Res.*, 26 (2): 293-296.

North of New Guinea, the eastward flow is not fast enough to bring the diluted water from the westernmost Pacific to the Coral Sea where, in the north, from February to June, the surface salinity is less than 34.5 ‰. This low salinity is always associated with a west wind component bringing rainfall. The surface salinity chart in January-February 1971 shows a salinity minimum isolated from its once supposed western origin by saltier water in the north of New Guinea. These features suggest local formation of this low salinity.

DRYSDALE F. R. and M. G. BARBOUR, 1975. Response of the marine angiosperm *Phyllospadix torreyi* to certain environmental variables: A preliminary study. *Aquat. Bot.*, 1 (2): 97-106.

Leaf growth of *Phyllospadix torreyi* was noted both in the field and in laboratory culture. Winter growth rate in the field did not seem to depend on aspect or slope of substrate. In that part of the intertidal zone which it dominates, average dry weight of *P. torreyi* leaf material was about 300 g/m². We hypothesize that the spring growth rate is greater than the measured winter rate, and that increasing daily incident light energy triggers the change. In the laboratory cultures, optimum growth occurred in full strength sea water (29,000 ppm) under 100 lm/ft² light intensity (12-h day), and at a water temperature of 12-14°C. Growth declined in lower salinities, under lower light intensities, and at higher temperatures. However, the magnitude of decline indicated that tolerance ranges of *P. torreyi* for salinity, light, and temperature are relatively broad.

DUBOIS R. N., 1975. Support and refinement of the Bruun rule on beach erosion. *J. Geol.*, 83 (5): 651-657.

If a beach and nearshore profile is at equilibrium, as sea level rises, the Bruun rule on beach erosion indicates that foreshore erosion will take place in order to provide sediments to the nearshore so that the nearshore profile can be elevated in direct proportion to rising sea level. This study supports the concept that rising sea level can cause beach erosion. At Terry Andrae State Park, Wisconsin, which borders Lake Michigan, a field study conducted from spring to fall of 1971 shows that when wave energy was reasonably constant the beach eroded by about 23 feet as lake water level rose by 1 foot. Of the 23 feet about 6 feet was lost solely due to the drowning effect of rising water level. Also, for a given wave energy level, the foreshore zone increases in elevation in direct proportion to the increase in the elevation of the water level and the foreshore zone retreats parallel to itself with rising water level.

DÜING W., P. HISARD, E. KATZ, J. MEINCKE, L. MILLER, K. V. MOROSHKIN, G. PHILANDER, A. A. RIBNIKOV, K. VOIGT and R. WEISBERG, 1975. Meanders and long waves in the equatorial Atlantic. *Nature, Lond.*, 257 (5524): 280-284.

Observations from the GATE Equatorial Oceanographic Experiment are presented. They reveal large scale meandering of the westward flowing South Equatorial Current and of the eastward flowing Equatorial Undercurrent with time scales of 2-3 weeks. Meandering of the flow pattern was found to be related to corresponding displacements of the high salinity core of the undercurrent. The observations tend to support the assumption of a long wave propagating westward with a phase speed of 2.3 m s⁻¹ and a wavelength of 3,200 km. A possible explanation may be given in terms of unstable waves caused by large scale horizontal shear in the Equatorial Current System.

DUNBAR MOIRA, 1975. Interpretation of SLAR imagery of sea ice in Nares Strait and the Arctic Ocean. *J. Glaciol.*, 15 (73): 193-213.

SLAR imagery of Nares Strait was obtained on three flights carried out in January, March, and August of 1973 by Canadian Forces Maritime Proving and Evaluation Unit in an Argus aircraft equipped with a Motorola APS-94D SLAR; the March flight also covered two lines in the Arctic Ocean, from Alert to the North Pole and from the Pole down the long. 4°E. meridian to the ice edge at about lat. 80°N. No observations on the ground were possible, but some back-up was available on all flights from visual observations recorded in the air, and on the March flight from infrared line-scan and vertical photography.

The interpretation of ice features from the SLAR imagery is discussed, and the conclusion reached that in spite of certain ambiguities the technique has great potential which will increase with improving resolution. Extent of coverage per distance flown and independence of light and cloud conditions make it unique among airborne sensors.

DUNSTAN W. M., L. P. ATKINSON and J. NATOLI, 1975. Stimulation and inhibition of phytoplankton growth by low molecular weight hydrocarbons. *Mar. Biol.*, 31 (4): 305-310.

Experiments on 4 phylogenetically different phytoplankton exposed in culture to a range of concentrations of benzene, toluene and xylene showed a variety of growth responses for marine microalgae. The degree of influence of these aromatic hydrocarbons, all components of fuel oils and crude oils, varied with concentration, compound and species. Stimulation of growth in *Dunaliella tertiolecta* resulted from low $\mu\text{g/l.}$ concentrations of all three compounds, *Skeletonema costatum* showed no growth enhancement, while *Cricosphaera carterae* and *Amphidinium carterae* were intermediate in their reactions. Closed culture vessels were found to be necessary to retain these volatile hydrocarbons. Many of the previous laboratory studies on oil using standard methods (cotton plugs, screw caps or beakers) have overlooked the important influence of the volatile fraction. The species-specific stimulation of low concentrations was further shown in experiments with mixtures of No. 2 fuel oil. The volatile fraction was most biologically reactive, being the source of growth enhancement at low levels and a major growth inhibitor at high concentrations. Thus, a significant environmental effect of oil on marine primary production could be the growth stimulation of particular species by low molecular weight aromatic compounds resulting in an alteration of the natural phytoplankton community structure and its trophic relationships.

EITTREIM STEPHEN and JOHN EWING, 1975. Vema Fracture Zone transform fault. *Geology*, 3 (10): 555-558.

The east-west Vema Fracture Zone, located near 11°N in the Atlantic Ocean, is unique in that most of its active portion is covered by a thick sequence of flat-lying sediments. These turbidite sediments, which were deposited during approximately the past 1 m y are essentially an easterly extension of the Demerara Abyssal Plain in the western Atlantic basin adjacent to the Amazon Cone. An abrupt disturbance of these sediments was observed seismically along an east-west line connecting the two rift valleys. We interpret this feature as the trace of an active transform fault, representing relative plate motion over at least the past 500,000 yr.

ELGQUIST BENGT and MARGARETA WEDBORG, 1975. Stability of ion pairs from gypsum solubility degree of ion pair formation between the major constituents of seawater. *Mar. Chem.*, 3 (3): 215-225.

The stability constants of the ion pairs NaSO_4^- , KSO_4^- , MgSO_4^- , CaSO_4 , MgCl^+ and CaCl^+ were determined at 25°C and 0.7 M formal ionic strength, by measuring the solubility of gypsum ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$) in different media. The media used contained one or two of the following electrolytes: NaCl, KCl, MgCl_2 , NaClO_4 , $\text{Mg}(\text{ClO}_4)_2$, Na_2SO_4 . Values for the stability constants are 1.22, 1.84, 12.3, 30.6, 0.48 and $1.20 M^{-1}$, respectively and the solubility product for gypsum is $2.87 \cdot 10^{-4} M^2$. The distribution of the main constituents of seawater was calculated using these results and the values of the carbonate and bicarbonate constants given by Dyrssen and Hansson, (1972 - 73). The solubility of gypsum in seawater as calculated and determined experimentally was 21.43 mM and 21.10 mM, respectively.

ELNIKOV I. N., 1975. Determination of the true forms of the reflecting boundaries below the sea bottom from the continuous seismic profiling data. (In Russian; English abstract.) *Okeanologia*, 15 (2): 343-351.

The forms of the reflecting boundaries are shown to be distorted by recording due to non-directivity of the reception-emission system. In the presence of complicated interfaces the hodographs t_0 may reveal return loops and points. As a result of the solution of an inverse problem, the graphic and the analytic methods of determining the true forms of interfaces based on the hodographs t_0 are proposed.

EMBLETON B. J. J. and M. W. McELHINNY, 1975. The palaeoposition of Madagascar: palaeomagnetic evidence from the Isalo Group. *Earth planet. Sci. Letts*, 27 (2): 329-341.

Palaeomagnetic results are reported from the continental facies of the Triassic-Jurassic Isalo Group of Madagascar. Stability of the magnetic remanence was tested using the alternating field and progressive thermal demagnetization techniques. Results from 8 sites, 6 located in northwestern Madagascar and 2 from the southwestern region, yield a palaeomagnetic pole at 74.2°S, 97.1°E ($N = 8$, $A_{95} = 6.3^\circ$). Three models previously proposed to describe the drift history of Madagascar relative to Africa are considered and

the relevant geological and geophysical information is reviewed. The palaeomagnetic data are only consistent with the pre-drift model which places Madagascar off the east coast of Africa adjacent to Kenya and Tanzania. This is also the continental drift fit favoured on geological grounds.

EMILLIANI CESARE, STEFAN GARTNER, BARBARA LIDZ, KONETA ELDRIDGE, D. K. ELVEY, T. C. HUANG, J. J. STIPP and M. F. SWANSON, 1975. Paleoclimatological analysis of Late Quaternary cores from the northeastern Gulf of Mexico. *Science*, 189 (4208): 1083-1088.

Oxygen isotopic, radiocarbon, and micropaleontological analysis of deep-sea cores from the northeastern Gulf of Mexico identify an episode of rapid ice melting and sea-level rise at about 9,600 years B.C. This age coincides, within the limits of all errors, with the age of the Valders ice readvance and with the age assigned by Plato to the flood he describes.

ERIKSSON SVANTE, SVERKER EVANS and BO TALLMARK, 1975. On the coexistence of scavengers on shallow, sandy bottoms in Gullmar Fjord (Sweden). *Zoon*, 3 (1): 65-70.

The ecological separation of dominant scavengers on shallow, non-tidal, sand bottoms in Gullmar Fjord, Sweden (58°15'N, 11°28'E) was studied in the laboratory by investigating preference of substratum and tolerance to temperature and salinity. *Crangon vulgaris* and *Nassarius reticulatus* principally choose soft substratum, while *Pagurus bernhardus* and *Asterias rubens* prefer hard substratum. *Carcinus maenas* is intermediary between these two groups. Species choosing hard substratum also prefer artificial eelgrass to sand. *A. rubens* actually avoids sand. *N. reticulatus*, *Carcinus maenas*, and *P. bernhardus* prefer sand containing organic matter to clean sand. The following ranking was constructed according to temperature tolerance (100% survival): *Nassarius reticulatus* (0 - 33°C) > *Carcinus maenas* (0 - 33°C) > *Crangon vulgaris* (0 - 28°C) > *Pagurus bernhardus* (0 - 24°C) > *Asterias rubens* (0 - 22°C). If the species were ranked by salinity tolerance (100% survival), the following order was obtained: *Carcinus maenas* (5 - 54 ‰) > *Crangon vulgaris* (3 - 45 ‰) > *N. reticulatus* (9 - 45 ‰) > *P. bernhardus* (14 - 43 ‰) > *A. rubens* (13 - 38 ‰). The species showing the largest over-capacity for this biotope, viz. *Carcinus maenas*, *Nassarius reticulatus*, and *Crangon vulgaris*, are those which most clearly favour shallow bottoms and prefer soft to hard substratum.

FASHAM M. J. R. and M. V. ANGEL, 1975. The relationship of the zoogeographic distributions of the planktonic ostracods in the north-east Atlantic to the water masses. *J. mar. biol. Ass. U. K.*, 55 (3): 739-757.

Data on the distribution of 74 species of ostracods obtained from a series of horizontal hauls at a number of latitudes and depths in the north-east Atlantic were used to investigate the faunal zonation of this area. A factor analysis was used to divide the hauls into 10 groups all but one of which bore some relation to the temperature-salinity characteristics of the water from which the hauls were sampled. However, there was no simple one-to-one relationship between these zones and the various Atlantic water masses. Very few species were found that were restricted to only one of the zones. Finally the relationship of these results to other relevant work is reviewed.

FEVRIER ALAIN, MICHEL BARBIER and ALAIN SALIOT, 1975. Molécules organiques dissoutes dans l'eau de mer: capture par les Invertébrés marins (acide palmitique, alcool cétylique, dotriacontane). *C. r. hebdomadaire. Séanc. Acad. Sci., Paris*, (D) 281 (4): 239-241.

The oyster *Ostrea gryphea* L. and the sea anemone *Calliactis parasitica* Couch have been kept in sea water containing sodium palmitate-16 ¹⁴C, cetylic alcohol-1 ¹⁴C or dotriacontane-16, 17 ¹⁴C. Important incorporations of these precursors were observed in the lipid fractions. The results are discussed.

FLATHER R. A. and N. S. HEAPS, 1975. Tidal computations for Morecambe Bay. *Geophys. J. R. astr. Soc.*, 42 (2): 489-517.

A numerical finite-difference technique for computing tides in areas of shoaling water has been established and used to calculate the M_2 tide in Morecambe Bay. An essential feature of the method is the representation of drying banks, which appear as the water level falls on the ebb, and which are re-submerged on the flood as the level rises again. Since the non-linear advective acceleration should be important in shallow water, schemes for incorporating these terms are examined and the influence of advection on the tide assessed.

In a series of tests, the open sea tides applied to the outer boundary of the numerical bay model were taken first from existing tidal charts, then from calculations with a larger-scale encompassing model, and finally from observations of current. In each case, the computed tidal elevations within the Bay turned out to be in satisfactory agreement with those obtained from observations. However, it is significant that, in the first case, inaccuracy of the input tidal distribution deduced from charts gives rise to erroneous currents near the boundary.

FOWLIS W. W. and P. J. MARTIN, 1975. A rotating laser Doppler velocimeter and some new results on the spin-up experiment. *Geophys. Fluid Dynam.*, 7 (1): 67-78.

A laser Doppler velocimeter, LDV, has been successfully mounted on a high quality rotating turntable. The capability of this LDV is demonstrated by some detailed measurements of the relative flow during the spin-up of a homogeneous fluid in a cylinder.

Local measurements in water of the zonal flow component of magnitude 0.1 cm/sec have been made with an error of about 0.003 cm/sec. The spatial resolution was about 0.1 cm and the temporal resolution about 0.5 Hz. Effects on the flow due to absorption of the low power laser beam (5 milliwatts) and to the low concentration (3 ppm) of 0.5 micron diameter scattering particles were negligible. The results are compared with analytical theory and the agreement is good. For a Rossby number of 0.1, the weak inertial modes excited by the Ekman layer formation can be clearly seen and identified. The LDV offers great promise for checking numerical and analytical solutions against experiments. This is particularly true for contained flows where conventional probes often significantly disturb the flow.

FRECKER M. F. and C. C. DAVIS, 1975. Man-made eutrophication in a Newfoundland (Canada) harbour. *Int. Rev. ges. Hydrobiol.*, 60 (3): 379-392.

A comparative study in 1969 - 1970 of the phytoplankton and certain other parameters in St. John's Harbour and Aquaforte Harbour, located on the southeast coast of Newfoundland, led to the conclusion that St. John's Harbour which receives untreated sewage as a prime source of nutrients was by far the more eutrophic. Evidence for the eutrophic state was especially observed in the central basin, at Station 1 of the harbour. Here the bottom waters were deficient in oxygen especially during the summer months. Secchi disc readings were generally lower at this station, and the annual standing crop of phytoplankton was almost three times that at unpolluted Aquaforte Harbour. Also the proportion of the biomass contributed by the nanoplankton was greater in St. John's Harbour. One euglenoid occurred in bloom concentrations throughout the summer months and may possibly be considered as an indicator of organically-polluted waters.

FUJITA YUJI and BUHEI ZENITANI, 1975. Distribution of phototrophic bacteria in Omura Bay during the summer with special reference to brown *Chlorobium*. *J. oceanogr. Soc. Japan*, 31 (3): 124-130.

The distribution of phototrophic bacteria was investigated during the summers of 1969 and 1970 in Omura Bay of western Kyushu. Phototrophic sulfur- and nonsulfur-bacteria were distributed numerously in the mud and bottom water. Brown strains usually dominated in number. In a water column, except in bottom water, there were usually few or no phototrophic bacteria. On occasion, however, a large number of brown bacteria were found in the middle of a water column.

Six strains, two each of the purple, green and brown bacterial colonies, were isolated from mud and sea water. The purple and green bacterial strains were identified as belonging to the genera *Chromatium* and *Chlorobium*, respectively. The brown strains could not be identified using Bergey's manual, but were found to be similar to the brown *Chlorobium* described by Pfennig. All six strains required sulfide for growth. Heterotrophic tendency was greater for the purple and green strains than for the brown strains. Their growth was enhanced by the addition of thymine. Living cells, taken from enrichment cultures of mud samples from four stations, gave absorption spectra almost identical to the spectrum of brown *Chlorobium*. Thus it appears that during the summer brown *Chlorobium* is the dominant phototrophic bacterial group in Omura Bay.

GAGOSIAN R. B., 1975. Sterols in the western North Atlantic Ocean. *Geochim. cosmochim. Acta*, 39 (10): 1443-1454.

The sterol concentrations in fourteen surface and nine deep water samples collected from the continental shelf and slope waters of the western North Atlantic and Sargasso Sea ranged from 0.1 to 1.3 $\mu\text{g/l}$. seawater. Isolation and structural elucidation by gas chromatography and combined gas chromatography-mass spectrometry show that cholesterol and β -sitosterol (or clionasterol) are the major free sterols in both the surface and deep water. Fucosterol, brassicasterol, 22-dehydrocholesterol, campesterol (or 22,23-dihydrobrassicasterol), 22-methylenecholesterol, norcholestadienol, and stigmasterol (or poriferasterol) are found in lower concentrations at the surface and in the deep sea. Cholesterol is the major sterol ester in both the surface and deep water, while very low concentrations of other sterol esters were found. The ratio of total free sterols to total esterified sterols is approximately two in both the surface and deep water.

Marine sources of sterols in seawater include phytoplankton, yeasts, and marine animals such as crustacea and molluscs. Terrestrial plants also may contribute. Sterol transport to the deep sea may occur by convective overturn and vertical diffusion or from vertical fluxes of large particles from the surface.

GAMSAKHURDIYA G. R. and A. S. SARKISYAN, 1975. Diagnostic calculations of current velocities at 11 levels in the Black Sea. (In Russian; English abstract.) *Okeanologiya*, 15 (2): 239-244.

The calculations of the sea surface level ζ and horizontal velocities at different levels of the Black Sea are based on the given density fields. The results are compared to those obtained by the dynamic method. It is shown for the Black Sea that an acceptable function distribution may be obtained with due regard for the actual baroclinicity of the sea water and bottom topography.

GARNICH N. G., 1975. A model of the continuous evolution of the seasonal thermocline. (In Russian; English abstract.) *Okeanologiya*, 15 (2): 233-238.

Parameterization of mixing processes by billow turbulence is considered within the framework of a two-layer oceanic model. The proposed statistical model of the evolution of the fine structure of the density field makes such a parameterization possible. The computation results are presented illustrating the influence of billow turbulence on the evolution of the seasonal thermocline.

GARRATT J. R. and P. HYSON, 1975. Vertical fluxes of momentum sensible heat and water vapour during the Air Mass Transformation Experiment (AMTEX) 1974. *J. met. Soc. Japan*, (2) 53 (2): 149-160.

Vertical fluxes of momentum, sensible heat and water vapour were determined during the 1974 Air Mass Transformation Experiment at 3 sites using the eddy correlation and spectral density techniques. The paper describes these fluxes in terms of the bulk transfer coefficients during the cold air outbreak occurring between February 23rd and 28th. The evidence suggests an increase of the neutral drag coefficient (referred to 10 m) with wind speed, to a value of 2×10^{-3} for wind speed approaching 15 m s^{-1} , whilst the 'neutral' heat and w.v. transfer coefficients remain approximately constant at 1.5×10^{-3} over the wind speed range $4 - 15 \text{ m s}^{-1}$. The mean sensible and latent heat fluxes for this 5 day period, based on data from Taramajima and Miyakojima were 11 mw cm^{-2} and 55 mw cm^{-2} ($226 \text{ langley days}^{-1}$ and $1130 \text{ langley days}^{-1}$) respectively. The implied Bowen ratio of 0.20 is consistent with the measured sea surface temperature of 21°C , in agreement with the work of Priestley and Taylor (1972).

GARRISON G. R., R. E. FRANCOIS and E. A. PENCE, 1975. Sound absorption measurements at 10 - 60 kHz in near-freezing sea water. *J. acoust. Soc. Am.*, 58 (3): 608-619.

Sound propagation measurements at frequencies between 10 and 60 kHz were made in April 1974 under the pack ice near Pt. Barrow, Alaska. With a stationary transmitter at mid-depth, a series of sound level versus depth profiles at ranges between 40 and 1,300 m were obtained and used to calculate the absorption coefficient. Although the sound speed profile contained many small irregularities which caused undesirable fluctuations, no large features appeared that would change the average intensity at the ranges and depths at which the sound was received. The average temperature and salinity were -1.6°C and 32.3 ‰ , respectively. The calculated absorption values in decibels per kiloyard were 2.5 ± 0.5 at 10 kHz, 4.5 ± 0.5 at 20 kHz, 8.3 ± 0.5 at 30 kHz, 10.7 ± 0.4 at 40 kHz, and 13.9 ± 0.5 at 60 kHz. These values indicate a relaxation frequency, assumed due to MgSO_4 , of $27 \pm 5 \text{ kHz}$, a value much lower than that predicted by the Schulkin-Marsh equation, but about the same as that determined by Greene in similar low-temperature water.

GEISLER J. E. and R. E. DICKINSON, 1975. Critical level absorption of barotropic Rossby waves in a north-south flow. *J. geophys. Res.*, 80 (27): 3805-3811.

This paper analyses propagating wave solutions of the linearized barotropic vorticity equation near a critical level in a north-south flow $V(x)$. The long Rossby wave found to the west of a wave source passes through the critical level unaffected. The short Rossby wave found to the east of a source is attenuated across the critical level by a factor $\exp(-\pi \beta / l V^1)$, where l is the north-south wave number and V^1 the shear at the critical level. Wave velocity components (u, v) do not become infinite near the critical level. Numerical solutions show how Rossby wave propagation on a large-scale domain is affected by critical level absorption. Implications for ocean basin models where phenomena depend on Rossby wave reflection at a western boundary are discussed.

GIDSKEHAUG A., K. M. CREER and J. G. MITCHELL, 1975. Palaeomagnetism and K-Ar ages of the South-west African basalts and their bearing on the time of initial rifting of the South Atlantic Ocean. *Geophys. Jl R. astr. Soc.*, 42 (1): 1-20.

Palaeomagnetic and isotopic results from the Kaoko lavas, Hoachanas basalts and dolerite sills of South-west Africa indicate that the Upper Triassic-Lower Jurassic Stormberg flows of South Africa may have extended into SW-Africa and that younger igneous events of Lower Cretaceous age were simultaneous with the Serra Geral volcanism in Brazil. Five analyses on three samples of the Keetmanshoop sills gave K-Ar ages between 178 ± 4 and $199 \pm 4 \text{ Ma}$, four analyses of two samples of the Hoachanas basalts gave ages between 161 ± 3 and $173 \pm 2 \text{ Ma}$ and eight analyses of five samples of Kaoko basalt gave ages between 110 ± 4 and $128 \pm 2 \text{ Ma}$. The components of remanent magnetization used to compute palaeomagnetic pole positions for the Kaoko lavas (48°N , 93°W , $A95 = 3^\circ$) and for the Hoachanas basalts (61°N , 106°W , $A95 = 7^\circ$) are stable to alternating field and thermal demagnetization. Correlation on a pre-drift map and on a map reconstructed for 112 Ma BP between the palaeomagnetic poles from the Kaoko and Serra Geral lavas suggests that the South Atlantic had not opened appreciably by 112 Ma BP. Cretaceous pole positions for S. America and Africa on a map reconstructed for 80 Ma BP are also discussed.

GIESKES J. M. and MIRIAM KASTNER, 1975. Evidence for extensive diagenesis, Madagascar Basin, Deep Sea Drilling Site 245. *Geochim. cosmochim. Acta*, 39 (10): 1385-1393.

Deep Sea Drilling Hole 245, $31^\circ 32'\text{S}$, $52^\circ 18'\text{E}$ in the southwest Indian Ocean shows pronounced linear concentration-depth gradients in interstitial dissolved Ca, Mg and Sr. Electrical conductivity tests enable us to make the estimate of a constant diffusion coefficient with depth of about $2 \times 10^{-6} \text{ cm}^2/\text{sec}$. The shapes of the concentration-depth gradients suggest that the major reaction sites in this hole are situated in the basal sediments and/or underlying basalts. It is proposed that observed interstitial water concentration changes in Ca and Mg are related to alteration of basaltic material, whereas those in Sr are due to calcium carbonate recrystallization processes. Support for the basaltic material alteration hypothesis comes from petrochemical and mineralogical data. Geochemical data also indicate that the high contents in Fe and Mn of the basal sediments can be related to low temperature alteration of basaltic glass and not necessarily to "hydrothermal" activity.

GORODNITSKY A. M., 1975. On the structure of anomalous geophysical fields above the seamounts. (In Russian; English abstract.) *Okeanologia*, 15 (2): 276-281.

The results of the gravimagnetic studies of the seamounts of the World Ocean are analyzed. Based on the generalization of the surveys, three major types of the seamounts differing in the structure of anomalous geophysical fields are distinguished. A possibility is shown of using the results of gravitational and magnetic surveys for studies of the geological structure and genesis of seamounts and the establishment of their relation to regional bottom structures.

GRIMSHAW R. H. J., 1975. A note on the β -plane approximation. *Tellus*, 27 (4): 351-357.

A rational approximation procedure is used to derive a β -plane approximation for fluid flow on a rotating earth, and to distinguish it from other related approximations. The β -plane equations obtained here have a constant horizontal component of the Coriolis parameter, while the vertical component varies with latitude. This feature of the equations enables the vorticity and angular momentum principles to hold in their usual form. The importance of the horizontal component of the Coriolis parameter is illustrated for internal gravity waves near a critical level.

GUILLE A. et J.-F. PONGE, 1975. Application de l'analyse des correspondances a l'étude des peuplements benthiques de la côte catalane française. *Ann. Inst. océanogr., Paris*, (N.S.) 51 (2): 223-235.

The techniques of the factorial analysis of correspondences are recalled. Data on the benthic fauna of the continental shelf off the French catalan coast studied by Guille (1970), are submitted to this analysis. Previously identified benthic communities with one exception are thereby individualized. The bottom granulometric composition proves to have a preponderant influence on the distribution of benthic macrofauna in the special physiographical conditions of the zone studied.

GUILLE ALAIN et JACQUES SOYER, 1974. Bionomie benthique du plateau continental de la côte catalane française. 8. Macrofaune et meiofaune, rapports quantitatifs et biocénétiques. *Vie Milieu*, (B) 24 (2): 301-320.

In qualitative terms, the distribution of the populations of Harpacticoid copepods on the continental shelf of the French Catalan coast largely corresponds to the distribution of the communities of the macrofauna. Complementary units or bionomical subdivisions may nevertheless be distinguished according to the higher sensibility of the meiofauna to the physicochemical conditions, mainly thermic and granulometric. The structure of the populations of the two faunal stocks shows that the high specific diversity of the Harpacticoids varies only to a certain extent with different populations, whereas the different groups forming the macrofauna generally show a preference for one type of biotope in the region considered. These comparisons between taxocenoses, and between taxocenoses and biocenoses, seem to improve the bionomical definition of a region in spite of the different dimensional level of the ecological niche of the taxa considered.

In quantitative terms the density of macrobenthos is rather feeble as compared to the densities observed in the boreal zone, whereas the quantity of meiobenthic organisms is very similar. The latter category shows, therefore, a higher relative importance which is apparently related to its capacity to occupy small ecological niches and to proliferate in areas not favouring the development of macrofauna. The numerical quantitative evolution of the two stocks is parallel being related to the bathymetry; this is expressed by very steady numerical ratios. The biomass of the macrobenthos may be relatively independent of the density because of the diversity in the size of its components, in contrast to the meiobenthos. The weight ratio shows that meiobenthos corresponds to 4.75% of the biomass of the macrobenthos. On the continental shelf of the French Catalan coast, the importance of the meiobenthos in terms of ingested food and in terms of biomass entering the food chain is of the order of 24%.

HÄLLFORS GUY, KANGAS PENTTI and ANNIKKI LAPPALAINEN, 1975. Littoral benthos of the northern Baltic Sea. III. Macrobenthos of the hydrolittoral belt of filamentous algae on rocky shores in Tvärminne. *Int. Rev. ges. Hydrobiol.*, 60 (3): 313-333.

The community composition was studied quantitatively in two localities in 1968 - 1970. The average ash-free dry weights of the plants in a fully exposed and a moderately exposed locality were 48.6 g/m^{-2} and 93.3 g/m^{-2} , respectively. The average animal ash-free dry weights were 2.52 g/m^{-2} and 3.45 g/m^{-2} , and the average numbers of the animal individuals were $5,360/\text{m}^{-2}$ and $1,5450/\text{m}^{-2}$.

The communities are characterized by the strong dominance of a few species, viz. *Cladophora glomerata*, *Gammarus* spp. and chironomid larvae. The species diversity is thus very low. The seasonal aspects of species composition and abundances are presented, and some factors causing the differences between the localities are discussed.

HANSEN H. P., 1975. Photochemical degradation of petroleum hydrocarbon surface films on seawater. *Mar. Chem.*, 3 (3): 183-195.

Surface films of a crude-oil fraction were exposed to irradiation from different light sources. The physical behaviour is described. Degradation products were isolated and identified. Primarily they are aliphatic and aromatic acids and to a lesser extent alcohols and phenols. Acids were converted into their methylesters and identified by combined gas chromatography and mass spectrometry. The amount of oxidation products in the surface film was estimated by measurement of the CO-infrared absorption in the $1,700 \text{ cm}^{-1}$ region with Attenuated Total Reflection, or ATR, infrared spectroscopy. Comparison between the original crude-oil fraction and degradation products lead to an estimation of the decomposition rate under natural environmental conditions.

HARLIN M. M., 1975. Epiphyte-host relations in seagrass communities. *Aquat. Bot.*, 1 (2): 125-131.

Seagrasses are crucial to the life cycle of many marine organisms including over 100 species of algae. The leaves of seagrasses vastly increase the area on which algae can settle. Certain species of algae have specialized to the point that the surface of seagrass is the only environment in which they are found.

Epiphytes are distributed through the water column where they are advantageously exposed to light, nutrients and wave action. Nitrate and phosphate absorbed from leaves and roots of seagrass eventually leak into adjacent water where they are available to attached organisms before excessive dilution. Transfer of organic carbon is unlikely to be important as a metabolic substrate.

Potential applications that could result from an understanding of relationships between epiphytes and seagrasses might be: (a) suppression of growth where epiphytes are unwanted; (b) promotion, where they are considered desirable; and (c) observation of epiphytes to monitor environmental changes in seagrass communities. Future work should focus on: (1) what controls settlement of epiphytes; (2) whether the presence of epiphytes affects the host, and if so how; (3) exchange and/or competition for nutrients; (4) regulation of epiphytes by metabolic products from the host; (5) relative sensitivity of algal epiphytes and seagrasses to environmental parameters; (6) determination of the proportion of productivity by each component; and (7) interdependence with animals in the community.

HARPER C. W. Jr., 1975. Origin of species in geologic time: Alternatives to the Eldredge-Gould model. *Science*, 190 (4209): 47-48.

Formal statements of the Eldredge-Gould model, which proposes that new species have originated almost wholly through evolution in small peripheral isolate populations, and the phyletic gradualism model, which proposes that new species have originated through phyletic evolution in large, widely distributed populations, clarify the relationship of these models as extremes in a spectrum of possibilities, and suggest alternative models incorporating elements of both.

HASHIMOTO YUICHI, 1975. The general properties of the oceanographic conditions in the western parts of Wakasa Bay (the Tango-kai). (In Japanese; English abstract.) *Bull. Maizuru mar. Obs.*, 13: 16 pp.

Oceanographic conditions in the western parts of Wakasa Bay (the Tango-kai) were studied from data obtained by R. V. *Kuroshio Maru* of the Maizuru Marine Observatory and the R. V. *Tanyo Maru* of the Kyoto Prefectural Fisheries Experimental Station from 1952 to 1962.

Maximum and minimum monthly mean temperatures in the subsurface layer were obtained at all stations in September and March. Mean sea surface temperatures reach a maximum in August at some inner stations of the Tango-kai.

Vertical stability of the water is large in summer, but remarkably small in winter. Negative values indicating instability are obtained in winter at some northern stations in the Tango-kai. Small stability is due to the characteristic vertical distribution of temperatures in winter, when the temperatures rise with increasing depth. Standard deviations from the normal temperatures in 1952 - 1962 were great in summer and small in winter. The periodic fluctuation of the sea surface temperatures at St. C was observed, and periods of 7, 15 and 19 months were obtained by means of the periodogram analysis.

Chlorinities at the sea surface are always high in the northern Tango-kai and are remarkably low in the inner bay due to the influence of the River Yura. Chlorinities in the subsurface layer are different from those at the sea surface. Low chlorinity waters are absent in the subsurface layer and the standard deviations from normal chlorinities in 1952 - 1962 in the subsurface layer are smaller than those at the sea surface. Therefore, the influence of the River Yura is restricted within several meters from the sea surface. It is supposed from the mixing rate of fresh water to sea water that the influence of the river water is seen at the stations along the southeastern coast of the Tango-kai. Maximum chlorinities at most stations were obtained in May - June.

The transparency of water is great in the northern bay and is much less in the inner bay. In August, the greatest transparency was observed at all stations.

HECK C. B., 1975. Collective arrangements for managing ocean fisheries. *Int. Orgn.*, 29 (3): 711-743.

With the great spread and intensification of marine fisheries exploitation, the traditional fisheries regime of free and open access (part of traditional "freedom of the seas") has been modified by many regional or stock-related management arrangements, and is now undergoing drastic change through a radical extension of coastal state jurisdictions. This article deals mostly with the development of various regional and stock-related arrangements. After sketching the overall purposes of management, the article details some of the differences among competing states which have delayed or limited management arrangements, or otherwise complicated their development. Issues of allocation may be uppermost for competing interests, discussed here in the context of shifts from undivided to divided catch limits. The regulatory powers of intergovernmental fisheries commissions have generally been quite limited. While fisheries scientists have in some cases performed vital roles in encouraging regional arrangements, their information and advice has been of limited scope and influence in securing more restrictive regulatory regimes. FAO's Committee on Fisheries (COFI) might be called a global fisheries commission, though much of its most important work has related to animating and supporting arrangements of a regional character. The radical shift outward of national jurisdictions is rearranging fisheries exploitation in most parts of the world. Given the nature of the resource, however, some forms of regional or stock arrangements will still be needed if the overall purposes of management are to be realized.

HERBERT R. A. and C. R. BELL, 1974. Nutrient cycling in the Antarctic marine environment. *Br. Antarct. Surv. Bull.*, 39: 7-11.

Samples of marine mud and sea-water obtained from several depths off the coast of Signy Island have been examined, using liquid culture-enrichment techniques, for bacteria capable of cycling nitrogen and sulphur compounds. The results obtained indicate that, with the exception of nitrifying bacteria, those capable of carrying out the specialized reactions of the sulphur and nitrogen cycles have been isolated from all the marine samples so far examined. In addition, the data show that most of these bacteria are able, albeit more slowly, to carry out these reactions at low temperatures (c. 5°C).

HINDLEY J. P. R. and J. W. PENN, 1975. Activity measurement of decapod crustaceans: a comparison of white and infrared photographic illumination. *Aust. J. mar. Freshwat. Res.*, 26 (2): 281-285.

Activity of western rock lobsters *Panulirus longipes* and western king prawns *Penaeus latisulcatus* was investigated by time-lapse photography using white and infrared photographic flash on alternate days. The activity of the prawns, but not of the rock lobsters, was depressed significantly by white flash illumination, and it is concluded that such illumination should not be used in behavioural experiments without quantifying its effects.

HIROTA REIICHIRO and MAKOTO HARA, 1975. Zooplankton investigations in Yatsushiro-kai, western Kyushu, I. Regional and seasonal occurrence of the important zooplankton. *J. oceanogr. Soc. Japan*, 31 (3): 115-123.

The occurrence of zooplankton at 21 stations in Yatsushiro-kai, western Kyushu, was investigated in June, September and November of 1968, and March of 1969. Copepods predominated in the collected zooplankton. Although *Paracalanus parvus* was abundant in most of the surveyed region, other copepods occurred dominantly in the following order when going from the northeastern area toward the southwest: *Oithona nana* → *Acartia clausi* → *Microsetella norvegica* → *Oithona similis* → *Corycaeus* spp. Yatsushiro-kai can be characterized biologically by dividing it into two main regions. The northern half is more embaymental and the southern half is more oceanic, bordered by an area where *Microsetella norvegica* occurred as the dominant. The area where *Acartia clausi* occurred dominantly is the most embaymental in the northern half, and the area where *Corycaeus* spp. occurred dominantly is the most oceanic in the southern half.

HOBBS B. A., 1975. Electromagnetic induction in the oceans. *Geophys. J. R. astr. Soc.*, 42 (2): 307-313.

This review examines some numerical methods proposed for solving problems of electromagnetic induction in the oceans. An iterative method for dealing with inducing fields of low frequency is convergent and has been successfully programmed by Bullard & Parker for the real oceans. Difficulties exist in some proposed methods for dealing with high frequency inducing fields, but recent iterative methods appear to be convergent. One such method is applied to a specific (non-axisymmetric) problem.

HOFFERT MICHEL, CLAUDE LALOU, EVELYNE BRICHET, PHILIPPE BONTE et CÉLESTINE JEHANNO, 1975. Présence en Atlantique Nord de nodules de manganèse à noyaux d'attapulгите et de phillipsite authigènes. *C. r. hebd. Séanc. Acad. Sci., Paris*, (D) 281 (4): 231-233.

The presence in a volcanic zone of neoformations of attapulгите and phillipsite is attributed to hydrothermal activity. These formations serve to aid the formation of the cores of manganese nodules.

HONKURA YOSHIMORI, 1975. Partial melting and electrical conductivity anomalies beneath the Japan and Philippine seas. *Phys. Earth planet. Interiors*, 10 (2): 128-134.

Geomagnetic variation anomalies observed in the central part of Japan can be accounted for by highly conducting layers having a conductivity of 0.5 S/m or thereabouts beneath the Japan and Philippine seas. High temperature may be a possible cause of such layers if we take into account that temperature amounts to 1,000°C at a depth of 40 km beneath the areas of high heat flow in the Japan and Philippine seas.

It seems difficult, however, to account for a conductivity of 0.5 S/m which is unusually high at a depth of 50 km or so by means of high temperature only. We can interpret such a high conductivity in terms of partial melting of peridotite in the upper mantle, provided highly conducting molten material is interconnected. This is in good agreement with the interpretation of low-velocity zones beneath the Japan and Philippine seas in terms of a partial melting of 4 - 6%.

HUSSONG D. M., M. E. ODEGARD and L. K. WIPPERMAN, 1975. Compressional faulting of the oceanic crust prior to subduction in the Peru-Chile Trench. *Geology*, 3 (10): 601-604.

An oceanic crustal section has been derived for the Nazca plate and across the Peru-Chile Trench at lat 12°S. Although based on unreversed seismic refraction data obtained by the Airgun-Sonobuoy-Precision-Echo-Recorder (ASPER) technique, 12 crustal determinations along the profile provide sufficient data density to permit good correlation of velocity structure between the stations. A thin, high-velocity oceanic crust characterizes the region. A major apparent offset in the crustal layers is interpreted as a low-angle thrust fault dipping east at an average of 6° from the ocean floor 300 km west of the trench axis. This feature, and other indications of thrust faulting and crustal foreshortening, is evidence that the upper lithosphere, at least to the depth of the Moho, is undergoing compression prior to subduction in the trench.

IMBODEN D. M., 1975. Interstitial transport of solutes in non-steady state accumulating and compacting sediments. *Earth planet. Sci. Letts*, 27 (2): 221-228.

A general one-dimensional equation for interstitial transport in accumulating and compacting sediments under non-steady state conditions is derived. As a consequence of compaction the metric along the path of a given horizon, i.e., the spatial distance between neighbouring particles, changes continually. Special emphasis is put on the treatment of advection caused by compaction. The resulting partial differential equation for the interstitial concentration of a given solute contains terms which can be evaluated based on data from a single sediment core. In addition, an integral over the time-derivative of porosity appears which would make it necessary to compare cores from the same site but at different times. Under quite general assumptions this last term, may, however, be transformed into a form for which evaluation from a single core becomes possible. Several special solutions are treated such as total steady state, steady state at the surface, non-constant sedimentation rate with steady state compaction, and non-steady state with steady state compaction. The last case applies, e.g., to diffusion under the influence of changing boundary conditions at the water/sediment interface while the accumulation process remains in steady state.

INGHAM M. C., 1975. Velocity and transport of the Antilles Current northeast of the Bahama Islands. *Fish. Bull., Nat. mar. Fish. Serv., U.S.*, 73 (3): 626-632.

Meridional geostrophic velocities and volume transports were computed from data collected on six occupations of Standard Section A-7 by U. S. Coast Guard cutters. The section extends offshore from Cape Canaveral, Fla., along lat. $28^{\circ}35'N$ for about 520 nautical miles (960 km), but this study involved only that portion seaward of the 800-m isobath (situated at about long. $79^{\circ}30'W$), a portion which would transect the Antilles Current just before it merges with the Gulf Stream. The velocity sections did not reveal a broad northward flowing Antilles Current in the surface layer as has been shown on many average current charts in the past. Instead, the sections revealed a generally sluggish (≤ 10 cm/s) surface flow, either northward or southward. Imbedded in the low speed surface flow were two bands of higher speed (10 - 40 cm/s), one northward and the other southward, usually located in the vicinity of the 1,000-fathom (1,830-m) isobath. Computed net transport for the sections ranged from 30.4×10^6 m³/s northward to 6.4×10^6 m³/s southward, with an average of 8.6×10^6 m³/s northward, which is considerably less than customarily hypothesized to provide for the observed downstream increase in Gulf Stream transport between the Straits of Florida and Cape Hatteras, N.C.

The position of the band of relatively rapid southward flow corresponded approximately to the position suggested by Kort for the southward flowing Antilles-Guiana Countercurrent. A comparison of temperature-salinity properties in the bands showed them to be identical with each other but different from Florida Current water, making it highly unlikely that the bands are manifestations of two continuous currents, the Antilles Current and Antilles-Guiana Countercurrent, from different source areas. The identical temperature-salinity properties of the bands indicate that they are manifestations of eddies or a countercurrent formed by recurving of an adjacent current; the former alternative appears more likely.

The importance of the Antilles Current as a means of transporting significant quantities of pelagic ichthyoplankton into the Gulf Stream system is doubtful. The current speeds and transports appear to be substantially less than hypothesized and highly variable. An alternate means of transport of ichthyoplankton in the surface layer which may be in operation is Ekman drift generated by local winds, yielding a flow which may not be reflected in the field of mass and geostrophic computations.

JOHNSON BARBARA, 1975. Technocrats and the management of international fisheries. *Int. Orgn.*, 29 (3): 745-770.

The paper examines the role of the world's fishery technocrats and experts in international fisheries management. The system of management provided by the regionally based international fisheries commissions is organized on transgovernmental and transnational lines. Political delegates to the commissions are usually government technocrats, suggesting that the system is basically transgovernmental. However, the role of scientific advisers to the commissions is studied, since the group may preempt political control through its control on expertise. Results of a questionnaire sent to 900 scientists throughout the world are given, using the data from a structured sample of 84 scientists. Most were found to be trained as natural scientists, and most were employed directly by national governments or through government research institutes. "Elite" scientists in the group, and some executive heads of commissions were also analyzed, and found to have a generally cautious approach to problems of fishery ownership and management. In sum, the transgovernmental system itself was found to allow, yet set, the limits of transnational role playing by fishery experts.

JOHNSON D. R., E. D. BARTON, PETER HUGHES and C. N. K. MOOERS, 1975. Circulation in the Canary Current upwelling region off Cabo Bojador in August 1972. *Deep-Sea Res.*, 22 (8): 547-558.

Using a profiling current meter combined with several fixed-level current meters, the pattern of circulation in the Canary Current upwelling region off Cabo Bojador, $26^{\circ}N$, has been observed. This pattern is discussed in relationship to the hydrography. The following main features were found: (1) general equatorward alongshore flow, decreasing in speed with depth and nearly in geostrophic balance, (2) a near-surface, near-shore maximum of alongshore velocity over the continental shelf, (3) a weak poleward flow beneath 400 m along the continental slope, (4) a double-celled cross-shelf circulation system, (5) a bottom mixed layer over the shelf associated with onshore flow originating below 225 m offshore and (6) high variability due principally to semidiurnal internal tides.

JOHNSTON D. M., 1975. The economic zone in North America: scenarios and options. *Ocean Dev. int. Law J.*, 3 (1): 53-68.

This paper reviews five alternative scenarios arising out of the Third UN Conference on the Law of the Sea (LOS III), and evaluates six economic zone (EZ) options available to Canada and the United States. Three of these options assume a preference for establishing a single multipurpose zone; and the other three assume instead a preference for two or more separate unfunctional zones. In none of these situations is it expected that serious Canadian-U.S. conflict will arise with respect to living or nonliving resource claims in EZ waters. However, the two governments are far from agreement on the nature and extent of coastal-state jurisdiction over the prevention and control of marine pollution and the regulation of scientific research in EZ areas. On these two issues, it is especially important that Ottawa and Washington should engage in prior consultation before resorting unilaterally to any kind of EZ initiative during or after LOS III.

KAIZUKA SOHEI, 1975. A tectonic model for the morphology of arc-trench systems, especially for the echelon ridges and mid-arc faults. *Jap. J. Geol. Geogr.*, 45 (2): 9-28.

A tectonic model for arc-trench systems is proposed in order to explain the difference of scale between topographic units in the volcanic inner and non-volcanic outer arcs, and the existence of echelon ridges and mid-arc faults, of which the former occur mainly in the inner arc and the latter run along volcanic fronts. In this model, differences in mechanical properties between the inner and outer arcs are of prime importance. Strike-slip displacements of mid-arc faults and echelon ridges are attributed to a horizontal shift of the outer arc along the direction of the system concerned. Certain extensional and compressional features of island arcs are also attributed to a horizontal shift of the outer arc, which may be caused by oblique convergence between an oceanic and an arc-bearing plate.

KAJIHARA TAKESHI, YOSHINORI URA and MIYAKO TACHIBANA, 1975. Sessile animals on tar globules in the waters around the Ryukyu Islands. (In Japanese; English abstract.) *J. oceanogr. Soc. Japan*, 31 (3): 131-135.

A large number of tar globules with sessile organisms were collected from the surface tows taken with larval nets in the waters around the Ryukyu Islands during November and December, 1973. Bryozoans (one species), tubeworms (Serpulidae, *Jamua (Dexiospira) foraminosa* Moore and Bush) and goose barnacles (*Lepas pectinata* Spengler, *L. anatifera* Linné) were the most important species of sessile animals found on these tar globules. Sinking of tar globules by *Lepas* of middle or large size was suggested by the differences in their specific gravity.

KASHINTSEV G. L., 1975. Petrochemical peculiarities of the transformation of palagonitized basalts on the ocean bottom (In Russian; English abstract.) *Okeanologiya*, 15 (2): 282-288.

The detailed petrochemical and geochemical studies of two palagonitized basalt samples taken from 3,060 m and 4,800 m depths have shown that the palagonitization of tholeiitic basalt is accompanied by an intensive isolation from the rock of calcium, magnesium and insignificant amount of silica. An appreciable amount of potassium is added to the rock. The behaviour of iron, aluminium, titanium, chromium and sodium is inert. Palagonitization of alkaline basalt is accompanied by an isolation from the rock of silica, calcium and sodium. Potassium and magnesium do not change their concentrations. Four stages of basalt transformation under deep-sea conditions are distinguished: syngenetic and diffusion palagonitization, hydrothermal leaching and underwater weathering. Iron-manganese ore crusts are formed through the isolation from the rock of Fe, Mn, Ni, Co, Sn, Mo and sorption from the sea water of Pb, Hg, Yb, La, Bi, W and Be.

KENT P. E., 1975. Review of North Sea Basin development. *Jl geol. Soc. Lond.*, 131 (5): 435-468.

The large amount of data now available on the North Sea stratigraphy, and on the history of the positive structures which form the sites of the oilfields, provides a basis for a review of basin development.

The area was initially occupied by two inter-cratonic basins: the Northern Basin had a Devonian ancestor; the Southern Basin dates back at least to the Carboniferous. During the Permian and Trias broad intercratonic subsidence continued in the south, but rifting developed across the separating Mid North Sea High and in the Northern Basin. Rifting (taphrogenic) control of subsidence became widely dominant through the Jurassic and lower Cretaceous, dying away in the upper Cretaceous, with major subsidence in the Viking Graben in the Northern Basin and in a series of narrow troughs in the south. No opening of the crust was associated with the central rifting: deep penetrations have encountered Devonian or Precambrian in the rift floor. For the most part the upper Cretaceous sagged into the earlier depressions with minor faulting only, but in the south inversion of the troughs took place in late Cretaceous and early Tertiary times; this may have had a compressional (orogenic) cause.

The Tertiary basin developed as a single, relatively simple synclinal subsidence of the whole North Sea area, centred on the main rift system but showing an absence of fault-control.

Interruptions in deposition on the individual structural high areas show wide correspondence in the North Sea. Except for a major late Triassic movement limited to the Netherlands and adjoining areas they show also close relation to those in Britain. The most notable are early middle Jurassic, early upper Jurassic and end Jurassic/lower Cretaceous. These produced erosional phases even in the deeper parts of the basin. They were entirely of epeirogenic type.

Halokinetic movements of Permian salt produced many local complications (especially in the Southern North Sea Basin) with consequent structural and stratigraphical anomalies from the middle Trias onwards.

KHODAIR A. A. and R. S. COE, 1975. Determination of geomagnetic palaeointensities in vacuum. *Geophys. J. R. astr. Soc.*, 42 (1): 107-115.

Specimens with low and intermediate Curie points from six Hawaiian historic basalt flows were used for the determination of the intensity of the historic geomagnetic field by the Thelliers' method. The specimens were heated either in air or in a vacuum of 10^{-5} torr. The regional intensity of the Earth's magnetic field at the time of extrusion of these rocks is known from direct observations. The palaeointensities determined in vacuum from four low and intermediate Curie point flows are correct within the uncertainty caused by the local field anomalies, whereas those determined in air from the same four flows are of lesser quality and accuracy. Unaltered submarine basalts have similarly low Curie points and thus may also be amenable to palaeointensity determination in vacuum. The behaviour of the remaining two flows, which had higher Curie points, was more erratic, and they yielded less accurate palaeointensities regardless of whether they were determined in air or vacuum.

KNOLL A. H. and E. S. BARGHOORN, 1975. Precambrian eukaryotic organisms: A reassessment of the evidence. *Science*, 190 (4209): 52-54.

Comparison of partially degraded unialgal cultures of *Chroococcus turgidus* with coccoid microfossils from the Late Precambrian Bitter Springs formation, Australia, suggests that the Precambrian fossil record has been seriously misinterpreted. Use of degradational features as taxonomic characters has resulted in unrealistically high estimates of Precambrian algal diversity. There is at present no compelling evidence for the presence of eukaryotic microfossils in rocks from the Bitter Springs formation or any older sedimentary sequences.

KONO YOSHITERU and TOSHIKATSU YOSHII, 1975. Numerical experiments on the thickening plate model. *J. Phys. Earth*, 23 (1): 63-75.

A model in which the plate (lithosphere) thickens with time away from oceanic ridges is presented here and details of numerical experiments are reported. In this model, the plate develops on the balance of the heat budget between input heat flow from the asthenosphere, release of solidification heat at the plate-asthenosphere boundary, and cooling from the surface. It is demonstrated that the thickening plate model is fully consistent with the various geophysical observations such as gravity anomalies, surface heat flow, water depth in ocean basins and physical properties of the asthenosphere and the lithosphere.

KORNICKER L. S., 1975. Antarctic Ostracoda (Myodocopina). *Smithson. Contr. Zool.*, 163 (2 parts): 720 pp.

Extensive benthic collections of myodocopid ostracodes made principally from the research vessels *Eltanin*, *Anton Bruun*, *Hero*, and *Vema* between Antarctica and 35°S, but including some previously reported collections, contain 35 genera, of which 10 are new, and 122 species, of which 60 were previously undescribed. Diagnostic keys are presented to assist in identification. Faunal resemblances between areas based on the Simpson Index are highest between Antarctica and South America, lowest between Antarctica and southern Africa and intermediate between Antarctica and New Zealand and Antarctica and Australia. Four bio-facies are delimited: (1) *Skogsbergiella-Empoulsenia* bio-facies, which includes shelf and bathyal depths, has outer limits roughly coinciding with the boundary of the Subantarctic region; (2) *Cypridinodes* bio-facies, which includes shelf and upper slope depths, extends south from the Indo-West-Pacific region and includes Australia and New Zealand; (3) Rutidermatidae bio-facies, which is restricted to shelf depths, extends southward into the study area along the coast of Chile; (4) *Spinacopia-Metavargula-Azygocypridininae* bio-facies, which is restricted mainly to bathyal and abyssal depths, includes all abyssal and lower bathyal regions of the Antarctic and extends northward into other oceans. The relationship of morphology and feeding habit to distribution is investigated; some new data on reproduction are analyzed; and the microstructure of the carapace, the upper lip, and some appendages is examined with the aid of the scanning electron microscope.

KORNICKER L. S., 1975. Ivory Coast Ostracoda (Suborder Myodocopina). *Smithson. Contr. Zool.*, 197: 46 pp.

This is the first record of Ostracoda in the suborder Myodocopina from the continental shelf of the Ivory Coast. Only three species were in the collections: *Cycloleberis squamiger* (Scott, 1894), *Asteropteron setiferum* Kornicker and Caraion, 1974, and *Rutiderma leloeuffi*, new species. Data are presented on the intraspecific variability of the first two species. Supplementary descriptions are presented of two additional species: *Cycloleberis galathea* Poulsen, 1965, and *Sarsiella murrayana* Scott, 1894.

KREBS WOLFGANG, 1975. Formation of southwest Pacific island arc-trench and mountain systems: plate or global-vertical tectonics? *Am. Ass. Petrol. Geol. Bull.*, 59 (9): 1639-1666.

If one takes into account active as well as remnant or inactive trenches and island arcs, the southwest Pacific island arc-trench system (New Zealand, Fiji plateau, New Guinea area, Banda arc, Philippines) is a complex of bilateral symmetrical structures. It is generally comparable to mountain belts, with foredeeps and deep-sea trenches, crystalline belts, and volcanic arcs, intermediate furrows and interarc basins, as equivalent structures. The southwest Pacific island arcs, back-deeps, and interarc basins represent a postorogenic (subsequent) stage and are characterized by subsidence and inversion of former intermediate massifs. The active deep-sea trenches form narrow foredeeps in a late geosynclinal stage.

The origin of the southwest Pacific island arc-trench systems specifically and of mountain belts in general is explained by the hypothesis of global vertical tectonics. Key areas for understanding the mountain belts and island arc-trench systems are the intermediate massifs, intermediate furrows, and interarc basins which represent the top of diapir-like upwelling material from the asthenosphere. These subcrustal asthenoliths are characterized by crustal thinning, extension, inversion structures, high mean heat flow, deep earthquakes, positive gravity anomalies, extrusion of mantle-derived tholeiite basalts, and intrusion of ultramafic massifs.

The forces caused by the rising of asthenoliths are primarily vertical; horizontal stresses of secondary origin are gravity controlled. Accretion ("cratonization") and destruction ("oceanization") of continental crust, extension in the inter-arc basins and intermediate furrows and local shortening in the deep-sea trenches and foredeeps are contemporaneous in island arc-trench systems and mountain belts. Consequently the proposed model of global vertical tectonics is incompatible with the hypothesis of plate tectonics. Global vertical tectonics explains the evolution of island arc-trench systems and mountain belts in a much simpler way than the hypothesis of plate tectonics, which needs some auxiliary assumptions to interpret the bilaterally symmetrical mountain belts and the magmatic and geophysical phenomena behind the island arcs.

KRIVELEVICH L. M., 1975. Nonlinear problem on wind-driven currents in the low latitudes. (In Russian; English abstract.) *Okeanologiya*, 15 (2): 251-255.

The non-linear problem on a wind-driven circulation of homogeneous liquid in the low latitudes is considered. The influence of depth of a basin, coefficients of mixing and nonlinear terms on the character of the wind-driven circulation is investigated. Level inclination values are determined. It is shown that the generation of the Cromwell-Lomonosov type current within the framework of the model of homogeneous liquid with a fairly great depth fails.

KÜHNER EUGEN und HANNELORE KURTH, 1973. Untersuchungen am Phytoplankton des nördlichen Zentralatlantiks. II. Das Phytoplankton im Seegebiet vor Nordwestafrika nördlich von Cap Blanco. *Wiss. Z. Univ. Rostock*, 22 (10): 1165-1168.

Investigation of the phytoplankton (mainly diatoms) to the north of Cap Blanco show that nutrient-rich water has risen in the area covered by three southern stations, and that this upwelling process is still continuing. Due to the young body of water, the number of phytoplanktonic organisms did not exceed 170,000 cells/l. The phytoplankton had developed strongly (up to 875,000/l.) in the areas covered by the central and northern stations. The oxygen content rose noticeably, whereas the nitrate and phosphate values dropped.

KURTH HANNELORE und EUGEN KÜHNER, 1973. Untersuchungen am Phytoplankton des nördlichen Zentralatlantiks. I. Das Phytoplankton der küstenfernen Region (offshore) auf 30°W in Relation zu einigen produktionsbestimmenden Umweltfaktoren. *Wiss. Z. Univ. Rostock*, 22 (10): 1159-1163.

Plankton samples taken in May and November, 1971, at 30°W between 15°N and 1°S were evaluated qualitatively and quantitatively. The phytoplankton in this area is only sparsely developed. Correlations to the depth and the thermocline are shown. Since nutrients are greatly concentrated at the thermocline, the amount of phytoplankton in the euphotic layer increases as the depth of the thermocline decreases. Relationships to the Equatorial Undercurrent and the phosphate maximum are also indicated. Although diatoms are dominant in coastal waters, peridinea predominate at the stations on 30°W.

KUWAHARA AKIHIKO, MAKOTO KASHIWAI and MASATOSI SINODA, 1975. Effects of temperature and chlorinity on the microdistribution of *Favella taraikaensis* Hada (Ciliata) in Maizuru Bay. *J. oceanogr. Soc. Japan*, 31 (3): 109-114.

Continuous sampling of the plankton with a pump sampler was carried out along a 960 m straight-line course in Maizuru Bay. The 25 collections of plankton were successively obtained at a depth of 1.5 m along the course, each of the collections covering a horizontal distance of 38 m. Vertical samplings of the plankton were done at five different depths: 90, 120, 150, 180 and 210 cm, at 13 stations along the course. In both kinds of samplings temperature and chlorinity were measured.

In the horizontal distribution of *F. taraikaensis*, it was demonstrated that the counts of plankton had no correlation with the temperature and chlorinity *in situ*. There was a correlation between the counts and the differences of temperature and chlorinity between two successive sampling stations. It seemed that *F. taraikaensis* was most abundant in the locations where the temperature difference was greater than + 0.2°C and the chlorinity difference was greater than +0.04 ‰. This species was more abundant around the steep thermocline and the steep halocline. When the vertical profiles of temperature and chlorinity did not show steep gradients, this species was more abundant near the surface.

LAMBOY M. et G. S. ODIN, 1975. Nouveaux aspects concernant les glauconites du plateau continental Nord-Ouest Espagnol. *Revue Géogr. phys. Géol. dyn.*, 2 (27) (2): 99-120.

Oceanographic research on the continental shelf north-west of Spain has revealed an abundance of glauconite. Ray diffractometry shows a mineralogical development between two established ranges of glauconite grains. The more developed of the minerals is well-closed glauconite mineral (8.5% of K₂O) but some structural disorganization persists. Detailed study of the nanofacies has shown a link between the mineralogical nature of the components and the intragranular micro-environment. It would appear that a greater degree of confinement leads to better developed crystals. On the Spanish shelf, carbonate debris form an environment of

geochemical exchange which is remarkably well suited to the genesis of phyllite. We note again the important part played by porous granular facies previous to the formation of glauconites. Geochronology has shown that the glauconites are authigenic and post-Miocene.

LANE J. W., 1975. Optical properties of salt ice. *J. Glaciol.*, 15 (73): 363-372.

The dependence of the extinction coefficient on salinity was investigated for both NaCl-ice and salt-ice made from natural sea-water. Specimens were prepared under a variety of conditions and examined over the wavelength range 4,000 to 8,000 Å. The effects of scattering from air bubbles trapped in the ice were examined for ice made from distilled water. It was found that the method of preparing samples markedly affected their structure, but that, when prepared in the same manner, salt-ice made from natural sea-water and NaCl-ice did not show significantly different transmission properties. It was found that, for a wavelength of 6,328 Å, the data could be fit to the relation $k_e = [1.67 - 0.85 \exp(-0.27x)] \text{ cm}^{-1}$ within an uncertainty of 26%, where k_e is the extinction coefficient, x is the salinity of the ice in g/kg. Within an uncertainty of 10%, there was no variation in transmission for ice at the same temperature and salinity over the wavelength range 4,000 to 8,000 Å. All measurements were made at a temperature of -20°C .

LARSON T. R. and J. W. WRIGHT, 1975. Wind-generated gravity-capillary waves: laboratory measurements of temporal growth rates using microwave backscatter. *J. Fluid Mech.*, 70 (3): 417-436.

The growth rates of wind-induced water waves at fixed fetch were measured in a laboratory wave tank using microwave backscatter. The technique strongly filters out all wavenumber component pairs except for a narrow window at the resonant Bragg scattering conditions. For these waves the spectral amplitude was measured as a function of the time after a fixed wind was abruptly started. The radars were aligned to respond to waves travelling in the downwind direction at wavelengths of 0.7-7 cm. Wind speeds ranged from 0.5 to 15 m/s. Fetches of 1.0, 3.0 and 8.4 were used. In every case, the spectral amplitude initially grew at a single exponential rate β over several orders of magnitude, and then abruptly ceased growing. No dependence of the growth rate on fetch was observed. For all wavelengths and wind speeds the data can be fitted by $\beta(k, u_*, \text{fetch}) = f(k) u_*^n$, with $n = 1.484 \pm 0.027$. Here u_* is the friction velocity obtained from vertical profiles of mean horizontal velocity. For each wind speed, $f(k)$ had a relative maximum near $k = k_{\text{min}} \approx 3.6 \text{ cm}^{-1}$. Rough estimates of $\beta/2\omega$, where ω is the water wave frequency, and of the wind stress supported by short waves indicate that the observed growth rates are qualitatively very large. These waves are tightly coupled to the wind, and play a significant role in the transfer of momentum from wind to water.

LEES ALAN, 1975. Possible influence of salinity and temperature on modern shelf carbonate sedimentation. *Mar. Geol.*, 19 (3): 159-198.

In modern, marine, carbonate sands from shelf areas between the equator and latitudes 60°S and 60°N several major grain associations can be distinguished.

On open shelves (< 100 m water depth) there are two skeletal grain associations. One (chlorozoan) is virtually restricted to warm, tropical waters; the other (foramol) characterizes temperate waters but also extends into the tropics. The distribution of these two associations cannot be explained in terms of water temperature alone: salinity is suspected as being a further controlling factor. Indeed, a third skeletal association (chloralgal) appears to be characteristic of areas where salinity is higher than on open shelves.

Non-skeletal grains, where present, can be grouped into two associations. In one, pellets are the only non-skeletal grains represented; in the other, ooliths and/or aggregate grains are also present. These non-skeletal associations are restricted to relatively warm waters, but temperature does not determine which one of the associations develops. Again, salinity seems important.

As both salinity and temperature apparently influence the grain associations, an attempt is made to present the relationships diagrammatically. By using graph pairs of "maximum temperature / minimum salinity" and "minimum temperature / maximum salinity" (named S. T. A. R. diagrams after Salinity Temperature Annual Ranges), the various grain associations can be classed into separate salinity / temperature fields.

Salinity and temperature often seem to have a mutual "compensating" effect. For example, even at high temperature the chlorozoan association does not develop if the salinity falls below a certain value, but it develops at relatively low temperatures when salinity is sufficiently high. This "compensation" effect also appears on the S. T. A. R. diagram for non-skeletal associations. More striking here, however, is a relationship suggesting that development of the oolith / aggregate association is strongly dependent on salinity.

Carbonate muds are not shown on the S. T. A. R. diagrams, but an attempt is made to assimilate them into the model.

The S. T. A. R. diagrams have a predictive value. In principle, given salinity and temperature values for an area, the grain associations can be predicted. In fact, the prediction is one of "potential", i.e. that which is to be expected provided any other necessary environmental conditions are satisfied. Predictions are presented for the shelves of an ideal ocean and of present-day oceans and seas. The S. T. A. R. diagrams thus provide the basis for a tentative global model of present-day shelf carbonate sedimentation.

The special problems of land-locked seas are discussed with reference to the Mediterranean Sea and the Persian Gulf. Predictions are presented.

To illustrate the possibilities of the S. T. A. R. diagram technique, an attempt at detailed prediction is given for an area – the Gulf of Batabano, Cuba – where the sediments are known and predictions can be checked.

In conclusion, the problems inherent in applying the model to ancient sedimentary systems are briefly discussed.

LIPKIN Y., 1975. *Halophila stipulacea*, a review of a successful immigration. *Aquat. Bot.*, 1 (2): 203-215.

The recorded expansion in the eastern Mediterranean of *Halophila stipulacea*, which appeared in this sea after the Suez Canal had been opened, is reviewed. The present geographical and ecological distributions of this plant in the Mediterranean are summarized and its phenology in this basin is discussed. Possible answers are presented to the questions of how the plant could reach the Mediterranean and expand in it, and why other Red Sea seagrasses did not follow the same route.

LIU HAN-SHOU, 1975. Dynamical model for the detachment of descending lithosphere. *Geophys. J. R. astr. Soc.*, 42 (2): 607-619.

The concept of gravity tectonics is applied to reveal the major clue as to the conditions which result in the correspondence of seismic and tectonic gaps in the mantle. An asymptotic theory is developed for the calculation of the thrust and moment when a descending lithospheric plate encounters resistance to its downward motion in the mesosphere. Dynamic analysis falls into two parts: (1) Deriving equations for forces in the descending lithosphere. (2) Deducing moment distribution which causes the detachment of lithosphere. For the analysis of forces a mathematical theory of shells is given. In order to determine the detachment mechanism, solutions of equations are obtained by asymptotic integration. It is found that a thrust N_ϕ coupled with a moment M_ϕ due to gravitational forces generated by density contrast may play a key role in the initial detachment of a piece of descending lithosphere. The results are in agreement with the observed seismic gaps beneath South America, Tonga-Fiji, New Zealand and New Hebrides regions.

ŁOMNIEWSKI KAZIMIERZ, 1974. The education and training of oceanographers in Poland. (In Polish; English abstract.) *Zesz. nauk. Wydz. Biol. Nauk Ziemi, Oceanografia*, 1974 (2): 121-134.

At the University of Gdańsk, education and training in physical and biological oceanography was begun in 1970. The biologists had already been through about 50 years of sea research, and undergraduates were trained in various courses at the departments of fishery of the colleges of agriculture.

In the past, physical oceanography has been largely descriptive. Precise methods and appropriately organised laboratories were introduced only about 15 years ago.

The Polish programme of training physical and biological oceanographers has been published in UNESCO publications of Working Group IOC (Training Education and Mutual Assistance), for its 1st Session in Paris, 7-13 March, 1973.

The programme of the 5-years' studies at the section of physical oceanography covers sea problems for a total of 2,200 hours. Much of the time is devoted to the physics and chemistry of the sea, sea-dynamics, maritime meteorology including the 'interaction' layer, and geology of the sea.

The programme of biological oceanography, with a similar number of lectures and classes, covers the biology of marine organisms, ecology of the sea, marine microbiology and biochemistry.

The undergraduates, 10 in each year of study, go through long periods of specialist practice on ships during exploratory trips, and in maritime institutes.

During the last year of their study the undergraduates prepare their theses on subjects most often relating to the research work of the maritime institute in which many of them find employment on graduation. The first graduates with complete university education left the university in 1973.

LØVALD J. L., 1975. In search of an ocean regime: the negotiations in the General Assembly's Seabed Committee, 1968-1970. *Int. Orgn.*, 29 (3): 681-709.

This study deals with the opening phase of the UN negotiations concerning the future international regime for ocean space. It seeks to establish how the technological and economic capabilities of member nations condition the manner and style of negotiation, the definition of national objectives, and the growth of attitudes and expectations with regard to such a regime. By the end of the 1968-70 period expectations about the future international regime had narrowed noticeably. Yet, for long-range tactical reasons many delegations were still holding out in anticipation of a new Law of the Sea Conference. The original Maltese seabed proposal envisaged a comprehensive international regime. In general, developing countries favored such a solution in the beginning, while industrialized countries preferred an intermediate solution. Eventually the Maltese proposal and the negotiating situation inadvertently set off a wave of claims for various forms of national jurisdiction. This meant that the emphasis at the end was more on the rights of the coastal states and less on the capacity of the world community to deal collectively with the future of ocean space.

LOVETT J. R., 1975. Northeastern Pacific sound attenuation using low-frequency CW sources. *J. Acoust. Soc. Am.*, 58 (3): 620-625.

CW acoustic transmissions received by ship-suspended hydrophones from seamount emplaced sources off San Diego of 750, 1,500, and 3,000 Hz; and submarine sonars of 1,500 and 2,500 Hz in the Gulf of Alaska result in attenuation coefficients significantly below values given by Thorp's equation. The present data, and the Sheehy-Halley very-low-frequency Pacific data, suggest a modified equation for CW transmissions.

LUBBOCK H. R. and N. V. C. POLUNIN, 1975. Conservation and the tropical marine aquarium trade. *Environ. Conserv.*, 2 (3): 229-232.

Although mainly developed in the last ten years, the international trade in tropical marine aquarium fishes has now reached remarkable proportions; in the U.S.A. the annual sales of aquaria, aquarium supplies, and aquarium fishes, probably approach U.S. \$600 millions, while estimates of the numbers of marine aquarium fishes exported each year from the Philippines alone range from about 3 to over 30 millions, valued at approximately U.S. \$1.25 million to over 6 millions. The exporting areas include the Philippines, Taiwan, Hong Kong, Thailand, Singapore, Indonesia, Australia, Sri Lanka, Ethiopia, Saudi Arabia, Kenya, Mauritius, the U.S.A. (Hawaii and Florida), and several Caribbean islands. The main importing countries are the U.S.A., Hong Kong, West Germany, Japan, U.K., Italy, Belgium, Canada, Australia, France, Holland, and Switzerland.

Species extermination through this trade alone is scarcely conceivable, but local extinctions may occur, and indirect effects of collection of these fishes include accompanying destruction of the coral-reef habitat, changes in natural ecosystems, and the possibility of successful introduction of exotic species into areas where they did not occur previously (notably, Indo-Pacific species into the Caribbean). Clearly the trade will continue; but the current exploitation is inefficient. Controls must be applied both towards rational utilization of the resource and, as the most accessible and richest reefs are the most heavily exploited, towards a reduction of conflicts between different uses of the resource.

LUTHER HANS, GUY HÄLLFORS, ANNIKKI LAPPALAINEN and PENTTI KANGAS, 1975. Littoral benthos of the northern Baltic Sea. I. Introduction. *Int. Rev. ges. Hydrobiol.*, 60 (3): 289-296.

The background and the aims of the Finnish IBP-PM programme are discussed. The research programme is outlined, with special reference to the study of the littoral communities. The research areas, Tvärminne, 59°50'N, 23°15'E, and Krunnit, 65°25'N, 24°50'E, are briefly described. The sampling programme, the sampling methods, the treatment of the samples and the gross structure of the collected material are presented.

LYUTSAREV S. V. and E. A. ROMANKEVICH, 1975. Organic carbon, phosphorus and nitrogen in the waters of the Sea of Japan. (In Russian; English abstract.) *Okeanologia*, 15 (2): 261-265.

Concentrations of dissolved and suspended organic carbon (C_p and C_b respectively), phosphorus (P_p and P_b respectively) and suspended organic nitrogen (N_b) were determined in 12 sea water samples collected with the 200 L water bottle at a station in the Sea of Japan (June 1972). The weighted mean concentrations for the 0 - 2,000 m layer were: 1.58 mg/l.⁻¹ for C_p , 17.9 µg/l.⁻¹ for C_b , 13.9 µg/l.⁻¹ for P_p , 0.185 µg/l.⁻¹ for P_b , 2.7 µg/l.⁻¹ for N_b , the $C_p : P_p$ ratio was 100 : 0.9 and $C_b : N_b : P_b$ was 100 : 14 : 1. The relationship between C_b and light attenuation factor ϵ (for the visible part of the spectrum) was described by equation $C_b \text{ µg/l.} \cong 170/\epsilon \text{ m}^{-1}$. The C_b concentration maximum in the upper layer was correlated with the maxima of phyto- and bacterio-plankton, and protozoa.

MANDICS P. A. and E. J. OWENS, 1975. Observations of the marine atmosphere using a ship-mounted acoustic echo sounder. *J. appl. Met.*, 14 (6): 1110-1117.

A monostatic acoustic echo sounder with a vertically-pointed antenna was installed aboard the NOAA research vessel *Oceanographer* and was tested during a recent cruise in the Pacific and Caribbean oceans. Acoustic returns produced by turbulence-induced temperature fluctuations were received from up to 300 m in height. The data revealed the existence of a rich variety in the structure of the marine atmosphere. Thermal convective plumes were usually observed when the sea water temperature exceeded the air temperature by as little as 1°C. Under more stable conditions the echo sounder detected the presence of layered structures associated with temperature inversions that were often perturbed by gravity waves or wind shear. Doppler frequency shift of the returned echo signals was used to estimate the vertical velocity of atmospheric scatterers.

The results of the tests indicate that it is possible to probe remotely the lower layers of the marine atmosphere from a moving ship using acoustic echo sounding techniques. Wind-generated noise, ambient acoustic noise, and structure-borne vibrations proved to be the major limitations on the performance of the echo sounder.

MARCOTTE B. M. and B. C. COULL, 1974. Pollution, diversity and meiobenthic communities in the north Adriatic (Bay of Piran, Yugoslavia). *Vie Milieu*, (B) 24 (2): 281-300.

Meiofauna were collected from five stations along a pollution gradient transect during January and July 1972. Municipal raw sewage was the source of pollution. Changes in the community structure of the meiobenthos and particularly in the species composition, diversity and survival strategy of the Harpacticoida, (Copepoda) in response to increasing organic enrichment were examined. Typical mud-dwelling meiofauna inhabited the polluted, detritus ooze sediments of the North Adriatic. Selective and non-selective deposit feeders were the dominant form of nematode. Faunal affinity analysis between stations indicated the existence of two harpacticoid copepod assemblages along the transect. In winter the copepods numerically dominated the most polluted stations. Copepod diversity decreased in response to increased enrichment. The Harpacticoida nearest the pollution source were dominated by one species: in winter, *Tisbe* sp. and in summer *Bulbamphiascus imus*.

Since organic pollution generates stress, this study serves as a meiobenthic field test of Sander's stability-time hypothesis under pollution conditions. Our data are consistent with the predictions of Sander's Model in that species diversity decreased with greater environmental stress. Comparison of these data with other meiobenthic diversity studies indicates that the effects of stress on meiobenthic communities are independent of its source.

MARSHALL NELSON, A. G. DURBIN, RAY GERBER and GREGORY TELEK, 1975. Observations on particulate and dissolved organic matter in coral reef areas. *Int. Rev. ges. Hydrobiol.*, 60 (3): 335-345.

Data are presented on the particulate and dissolved organic carbon at Eniwetok Atoll in the Pacific and of particulate organic carbon at South Caicos in the Caribbean. Some data from other locales are included for comparison. Proportionate increases are greater for the particulate matter released from off reefs than for the dissolved; in fact, the net flux of dissolved matter is sometimes negative. Particulate matter, in this case of the size and kinds retained on micro-filters, is dominated by fragments and amorphous material of mixed origins. Phytoplankton is sparse in such environments.

MARSHO T. V., R. P. BURCHARD and R. FLEMING, 1975. Nitrogen fixation in the Rhode River estuary of Chesapeake Bay. *Can. J. Microbiol.*, 21 (9): 1348-1356.

The distribution, seasonal variation, origin, and significance of biological nitrogen fixation has been determined for a Chesapeake Bay estuary using the acetylene reduction technique. Studies over a 15-month period have shown that nitrogen fixation occurs predominantly in the surface intertidal (marsh) and subtidal sediments. Negligible activity was found in surface waters. A marked seasonal variation in nitrogen fixation was observed for intertidal sediments incubated at a standard 20°C. Average rates of about 37 and 12 ng N/g dry sediment per hour were observed in the late fall months of 1972 and 1973, respectively, and ≤ 5 ng N/g dry sediment per hour during other seasons. Peaks of activity were lowered considerably when samples were incubated at ambient temperatures *in situ*. Activity in the subtidal sediments was low ≤ 6.8 ng N/g dry sediment per hour but showed a similar (~two-fold) seasonal variation in nitrogen fixation potential. Light-dark and substrate addition experiments suggest that heterotrophic bacteria are the principal agents for nitrogen fixation in sediments. Integrated estimates of nitrogen fixation in the estuary indicate that biological fixation probably accounts for $< 5\%$ of the total influx of nitrogen into the system. Rates of activity in the intertidal sediments are insufficient to account for the high productivity of marine angiosperms found in the marsh.

MARTIN J. M., F. M. PILTZ and D. J. REISH, 1975. Studies on the *Mytilus edulis* community in Alamitos Bay, California, V. The effects of heavy metals on byssal thread production. *Veliger*, 18 (2): 183-187.

The pelecypod *Mytilus edulis* was exposed to varying concentrations of six different heavy metal concentrations for a seven day experimental period and their mean byssal thread production and survival were measured. The effective concentrations of these six metals were determined. In order of decreasing toxicity the EC_{50} of these metals were: Mercury 0.2 mg/l., copper 0.25 mg/l., cadmium 0.5 mg/l., zinc 1.8 mg/l., lead 2.5 mg/l. and chromium 3.9 mg/l. The median lethal concentration for four of these six metals was determined. Values for lead and zinc were greater than the highest concentration tested. Comparisons of the EC_{50} to the levels of these six metals present in two large domestic sewage discharges in Los Angeles county and to the State of California water quality standards indicate that the values for cadmium, chromium, lead, and mercury are above the actual amounts in domestic sewers or standards; the EC_{50} values for copper and zinc fall within range of the values and standards.

MATTHEWS W. H. and J. C. PERKOWSKI, 1975. Integrating scientific knowledge for professional education in environmental management. *Environ. Conserv.*, 2 (3): 213-222.

A challenge in programmes for professional education in environmental management is determining how best to teach the required scientific and professional knowledge to environmental coordinators. This paper describes the work conducted at M.I.T. in collaboration with C.E.I.

The program uses a simplified model of the decision-making steps in environmental management. The model can be used for isolating types of decisions required in social, cultural, administrative and political contexts. When this has been done, the responsibilities and the educational needs of specific classes of 'environmental managers' can be identified through studies and interviews.

The program also requires the development of outlines and the identification of reference material for the disciplines that comprise environmental management. Major subject areas treated in this study are: values and perceptions, ecology, environmental effects and indicators, environmental impact assessment methodology, modelling, monitoring, growth and its future implications, economics, law and administration.

MAUL G. A. and H. R. GORDON, 1975. On the use of the Earth Resources Technology Satellite (LANDSAT-1) in optical oceanography. *Remote Sens. Environ.*, 4 (2): 95-128.

Observations of the Gulf Stream System in the Gulf of Mexico were obtained in synchronization with LANDSAT-1. Computer-enhanced images, which are necessary to extract useful oceanic information, show that the current can be observed by color (diffuse radiance) or sea state (specular radiance) effects associated with the cyclonic boundary even in the absence of a surface thermal signature. The color effect relates to the spectral variations in the optical properties of the water and its suspended particles, and

is studied by radiative transfer theory. Significant oceanic parameters identified are: the probability of forward scattering, and the ratio of scattering to total attenuation. Several spectra of upwelling diffuse light are computed as a function of the concentration of particles and yellow substance. These calculations compare favorably with experimental measurements and show that the ratio of channels method gives ambiguous interpretative results. The results are used to discuss features in images where surface measurements were obtained and are extended to tentative explanation in others.

MAYKUT G. A. and T. C. GRENFELL, 1975. The spectral distribution of light beneath first-year sea ice in the Arctic Ocean. *Limnol. Oceanogr.*, 20 (4): 554-563.

Spectral transmission data in the 400 - 1,000 nm range were obtained from about 60 sites beneath first-year sea ice near Point Barrow, Alaska. The amount of energy reaching the ocean depended strongly on the nature of the upper surface. Maximum transmission occurred in the 450-550 nm region, regardless of surface conditions or ice thickness. Initial results were influenced by the presence of interstitial algae in the lower part of the ice. The characteristic signature of these algae was a secondary peak at about 540 nm. Results are generalized to provide estimates of the magnitude and composition of downwelling irradiance beneath the types of ice typically encountered in coastal portions of the Arctic Ocean.

McKENZIE DAN and NIGEL WEISS, 1975. Speculations on the thermal and tectonic history of the earth. *Geophys. J. R. astr. Soc.*, 42 (1): 131-174.

The connection between the Earth's thermal history and convection in the mantle is exploited to elucidate the early evolution of the Earth. It appears probable that convection extending over almost all of the mantle has dominated vertical heat transport throughout the whole of the Earth's history. Only in boundary layers at the surface and at a depth of 650 - 700 km is conduction likely to be important. The resulting evolution appears to be consistent with geological observations on early Precambrian rocks.

Various arguments are put forward in favour of two horizontal scales of convective flow in the mantle at depths less than 650 km. The large scale flow is related to the motion of major plates, and must be ordered over distances of more than 5,000 km. Its evolution and energetics are discussed and there are no obvious problems in maintaining the proposed convective motions. Small scale flow with an extent of the order of 500 km appears necessary both to explain the heat flow through older parts of the Earth's surface and to reconcile the geophysical observations with the results of numerical experiments. Though the existence of the small scale flow is at present speculative, various tests of its presence are proposed.

MELNIKOV I. A., 1975. Fine-dispersed fraction of suspended organic matter in the east Pacific waters. (In Russian; English abstract.) *Okeanologia*, 15 (2): 266-271.

Quantitative and qualitative evaluation is given of the fine-dispersed fraction of suspended organic matter of the sea water. In the euphotic zone of the high-productive water this fraction is shown to comprise 86%, in the low-productive water it is 61%, and at depths below 200 m it is 53% of organic carbon of suspended matter. The formation of the fine-dispersed fraction and its role in energy distribution over the detritus food chain in the ecosystem are discussed.

MILLIMAN J. D. and EDWARD BOYLE, 1975. Biological uptake of dissolved silica in the Amazon River estuary. *Science*, 189 (4207): 995-997.

Approximately 25% of the dissolved silica carried by the Amazon River is depleted through diatom production in the inner estuary. Annual production of opaline frustules is estimated to be 15 million tons. However, few diatoms accumulate in modern shelf sediments and chemical recycling appears to be slight. Instead, many frustules apparently are transported landward into the river system, where they deposit in dunes and layers on and within mud and sand bars.

MISAKI MASAO, MIWAKO IKEGAMI and IZUO KANAZAWA, 1975. Deformation of the size distribution of aerosol particles dispersing from land to ocean. *J. met. Soc. Japan*, (2) 53 (2): 111-119.

When aerosols originated on land are dispersed over the ocean, they are not only decreased in concentration, but deformed in the pattern of size distribution. This deformation was ascertained by experiments aboard an observation ship in 1972 and 1974. Based on mobility spectrometry of atmospheric ions using apparatus we have developed, and the concurrent size spectrometry of large particles using a Royco Optical Counter, the whole size distribution of aerosol particles covering the radius range from 3 nm to 4 μm was determined over the cruising course of 1,000 km from Tokyo. With the aid of the result of ^{222}Rn concentration measurements, the effect of dilution associated with the spatial dispersion was estimated. Subtracting the dilution factor from the apparent decay rate of the aerosol concentration, the residence time of aerosols was determined in relation to the particle size. In both the expeditions in 1972 and 1974, the deformation of the size distribution was found to take place in such a way that the center of gravity of the distribution was shifted towards smaller size with the increasing age of aerosols.

MITCHELL-TAPPING H. J., 1975. Wave effect on sea grasses in the West Indies: The formation of the bare sand zone. *Geol. Mag.*, 112 (5): 515-518.

An examination of narrow zones of bare sand, usually averaging 10 m in width, situated between the patch reef and the sea grass beds (*Thalassia* and *Cymodocea*), shows that they appear to be primarily the result of wave action. Experiments were conducted

in the U. S. Virgin Islands over a period of 5 years, which show the effect of subsurface interference of wave patterns in the forming of these bare sand zones. It had previously been proposed that herbivorous fish and sea urchins (*Diadema antillarum* Philippi) accounted for these zones. The author thinks that these sand zones are a major factor in the equilibrium balance of sand quantity necessary for on and offshore transportation, and also in the balance of sand retained behind the patch reefs of the West Indies.

MIYAKE YASUO, TOSHIO SHIMADA, YUKIO SUGIMURA, KOJI SHIGEHARA and KATSUKO SARUHASHI, 1975. Distribution of tritium in the Pacific Ocean. *Rec. oceanogr. Wks Japan*, (N.S.) 13 (1): 17-32.

The results of determinations of the tritium content in sea water in the wide areas in the Pacific which have been carried out since 1957 are reported. Between the years from 1957 to 1965, the two maxima in the surface tritium content appeared in 1957 and 1963 both 19 TU on an average which were due to the big hydrogen bomb tests in 1956 and 1962. From November, 1968 to March 1972, the determinations were done at about 10 degree interval on the meridional lines along 170°W, 146°W and 100°W extended from 50°N to 60°S. In the surface waters the higher tritium content ranging from 3 to 15 TU was observed in the North Pacific, while it was lower in the South Pacific ranging 0.4 to 1.9 TU. Comparison between the fall rate of tritium by precipitation and the surface tritium content along the same meridional zone showed that there is an intimate correlation with each other. In addition, the relations between vertical profile of tritium content and the water density *in situ* in the ocean were studied. By using the surface tritium as a tracer, the residence time of water and the vertical eddy diffusion coefficient in the mixed layer were calculated. The estimated residence time of water was about 7 years and the vertical diffusion coefficient was 0.1 to 0.4 cm²/sec.

MIYOSHI HIDEO and KOICHI NAKAMOTO, 1975. Factors influencing bacterial distribution in the sea of Hiuchi-Nada area. *Bull. Jap. Soc. scient. Fish.*, 41 (6): 645-652.

With the aim of evaluating factors which may influence the bacterial distribution in the sea of Hiuchi-Nada area, bacteriological and oceanographic surveys were conducted. By regression analysis the following equation was obtained from 98 sets of observations: $\log Y = 0.104 X_1 - 0.515 X_2 + 0.003 X_4 + 2.745$ where Y is the number of total bacteria, X_1 is the temperature of water, X_2 is the temperature difference between sample and surface water, X_4 is the ultraviolet absorption value of water at 270 m μ . The multiple coefficient of determination adjusted for the degree of freedom was 77.7%. It seems reasonable to assume that only 3 variables, X_1 , X_2 and X_4 , were mainly involved in the seasonal, vertical and geographic distributions of total bacteria in the waters.

MOORE C. G., 1975. A review of the harpacticoid genus *Paraleptastacus* (Crustacea, Copepoda). *J. nat. Hist.*, 9 (5): 495-507.

The sympatric occurrence of three species of *Paraleptastacus* on Port Erin Beach and elsewhere around the Isle of Man provided the opportunity to study the comparative morphology and variability of the species. All three species, *P. spinicauda*, *P. espinulatus* and *P. holsaticus*, were found to be easily distinguishable when Manx specimens were compared with each other and with previous descriptions. The diagnoses of the genus and these three species are amended, the validity of other species in the genus discussed and a new key constructed for each sex.

MOSKALENKO L. V., 1975. Computation of stationary wind-driven currents in the Black Sea. (In Russian; English abstract.) *Okeanologiya*, 15 (2): 245-250.

The results of numerical computations of stationary wind-driven currents in the Black Sea are analyzed. The model is based on the transport stream function for a varying depth nonhomogeneous sea. The major peculiarities of water circulation in the sea are shown to be caused by a curl of the tangential wind stress. It is emphasized that not only cyclonic but also anticyclonic gyres can develop in the sea. The manifestation of β -effect is noted. The role of bottom relief in the formation of the general circulation pattern is shown.

MÜLLER CARLA and PETER ROTHE, 1975. Nannoplankton contents in regard to petrological properties of deep-sea sediments in the Canary and Cape Verde areas. *Mar. Geol.*, 19 (4): 259-273.

Nannoplankton assemblages from recent sediments of the deep-sea areas adjacent to the Canary and Cape Verde Islands are different. The distribution of nannoplankton is strongly related to the sediment type. The nannoplankton assemblage of the Canary Islands area, between the easternmost islands and Morocco, is influenced by the cold Canary current and also by continental-detrital sedimentation with reworked Cretaceous material. The samples from an area between the Cape Verde Islands do not contain reworked or cold-water species because of the shield effect of the islands. The material studied from the cores of both areas belongs to the youngest nannoplankton zone (*Emiliania huxleyi* zone, NN21).

MÜLLER F., H. BLATTER and G. KAPPENBERGER, 1975. Temperature measurement of ice and water surfaces in the north water area using an airborne radiation thermometer. *J. Glaciol.*, 15 (73): 241-250.

Ice and water surface temperatures were measured with an airborne radiation thermometer PRT-5 over the North Water polynya during three missions between late winter and early summer 1974. Error corrections, problems of data analyses and mapping are discussed. Attempts are made to relate the main types of sea ice to temperature ranges, which then are used in conjunction with satellite pictures to produce surface temperature maps.

MÜLLER PETER and D. J. OLBERS, 1975. On the dynamics of internal waves in the deep ocean. *J. geophys. Res.*, 80 (27): 3848-3860.

The dynamical processes affecting the evolution of a random internal wave field are considered. If the statistical properties of the internal wave field vary slowly with space and time, these dynamical processes can be treated as small perturbations about the local steady state of the free linear field. The time evolution of the wave field is then governed by a radiative transfer equation describing changes in the action density spectrum of the wave field along wave group trajectories. The source function describing these changes is determined by the superposition of all processes governing the generation, transfer, and dissipation of wave energy. Some terms of the source function, those corresponding to expansible processes, can be derived rigorously by using weak interaction concepts. Other terms, corresponding to nonexpansible processes which are governed locally by strongly nonlinear dynamics, cannot be determined completely. For the case where the internal wave field can adequately be described in the WKB approximation, a rather complete list of source terms is presented. The evaluation of these source terms is difficult partly because of their complicated functional structure and partly because the geophysical fields involved are not sufficiently known. Those source terms which have been evaluated in detail are briefly reviewed, and their implications on the energy balance of the internal wave field are discussed.

MULLER W. A., 1975. Competition for food and other niche-related studies of three species of salt-marsh foraminifera. *Mar. Biol.*, 31 (4): 339-351.

The niches of 3 species of salt-marsh foraminifera, *Allogromia laticollaris*, *Rosalina leei*, and *Spiroloculina hyalina* were assessed in the laboratory. The 3 species reproduce within the following ranges: temperature 10° to 33°C, salinity 12 to 45 ‰ and pH 5 to 10. Competition for food among the 3 species was evaluated. *S. hyalina* did not compete with other species. Intraspecific competition (crowding) appears to be an important factor limiting the reproduction of *A. laticollaris*. Crowding seems to have little effect on the other 2 species. The feeding of foraminifera is affected by the quality and quantity of food organisms. The feeding rate of the species tested is directly related to concentration within a range of 10² to 10⁶ cells fed. *S. hyalina* is a bacterial feeder. *A. laticollaris* is a rare species which may become locally abundant when dominant species are missing. *S. hyalina* is also a rare species, which can bloom where the density of bacteria is relatively high and in the absence of competing species. *R. leei* is a stable, conspicuous species, whose moderate numbers are relatively unaffected by physical stress and competition. Some new laboratory data on *Ammonia beccarii* were obtained so that this species could be compared with the others studied. Differences in niches are graphically presented.

NEPROCHNOV Yu. P., Yu. G. GANBAROV, Yu. D. EVSYUKOV, L. I. PETROVSKAYA, G. A. SEMENOV and B. V. KHOLOPOV, 1975. Experience in recording refracted waves from the pneumatic and gas sources in the Caspian Sea. (In Russian; English abstract.) *Okeanologiya*, 15 (2): 338-342.

The results are presented of the experimental-methodical work in the Caspian Sea aimed at elucidating the efficiency of the unexplosive sources for seismic refraction studies. The pneumatic sources (PS) were compared with the gas detonation device (GDD). The GDD with 60 l. total volume of the chambers is approximately similar to the PS with a 3 l. chamber. The pneumatic emitter with a 28.1 chamber has appeared to be most efficient as giving intensive refracted waves up to the end of the profile, 12 km. Waves of 2.0, 2.7, 2.9 and 3.9 km. sec⁻¹ velocities have been distinguished on the profile. Hodographs, amplitude graphs and an approximate seismic section have been constructed.

NEVESSKY E. N. and V. V. KOSTOGLODOV, 1975. New results of the lithological studies of bottom sediments with the aid of a multichannel radiometric survey. (In Russian; English abstract.) *Okeanologiya*, 15 (2): 289-295.

The work with the aid of a multichannel radiometric (gamma-spectrometric) survey was undertaken for the first time in the Soviet practice of marine geological studies. The method provides a means for a continuous obtaining of information from aboard a moving ship on the concentration and the distribution of natural radioactive elements (U, ²¹⁴Bi, Th, ²⁰⁸Tl, ⁴⁰K) in the upper layer of marine sediments. A brief description is given of a complex of instruments and procedures. Based on the studies with the multichannel radiometric survey in the Baltic Sea in 1974, some of the possible uses of this method in marine geology are shown.

NINKOVICH DRAGOSLAV and J. H. ROBERTSON, 1975. Volcanogenic effects on the rates of deposition of sediments in the northwest Pacific Ocean. *Earth planet. Sci. Letts*, 27 (2): 127-136.

Seven piston cores, 7-16 m long, taken between the Kuril Islands and Emperor Seamounts, have been dated using radiolarian and diatom extinction levels and correlated using volcanic ash layers. The average rate of deposition in the cores decreases from 6 cm/1,000 years near the Kuril Trench to about 3.5 cm/1,000 years near the seamounts. Dispersed volcanic ash is the main constituent of the cores and it comprises up to 80% of the sediments. The percentage of the ash in the sediments decreases eastward from the Kuril Islands as the rates of deposition decrease.

The total thickness of the sediments in the same latitudinal belt also decreases eastward. The thickness of the sediment inferred from seismic data near the Kuril Trench is about 600 m and rates of deposition are approximately 6 cm/1,000 years in the Pleistocene cores. Sediment thickness near the seamounts is about 300 m, and rates of deposition are approximately 3 cm/1,000 years in the Pleistocene cores. Extrapolated rates of deposition in these cores suggest that the age of the base of the sediment to the east of the Kurils is only about 10 m y.

The anomalously young age for the base of the sediments obtained by extrapolation of an assumed constant rate of deposition can be explained by Deep Sea Drilling Project data from the northwest Pacific. The sediment thickness at DSDP site 192 east of Kamchatka includes sediments from all the Cenozoic epochs except the Paleocene. Rates of deposition of sediment younger than Middle Miocene are an order of magnitude higher than those prior to this time. At DSDP sites east of Japan, either Late Miocene sediments lie directly on the basement, or sediments older than Late Miocene are very thin. Post-Middle Miocene sediments are composed primarily of glass shards. Thus, about 90% of the total thickness of sediments in the northwest Pacific is composed of sediments younger than Middle Miocene with volcanic ash as the main constituent. The volcanic ash results from the present phase of explosive volcanic activity which began in the Late Miocene in the northwest Pacific volcanic arcs.

NUTTALL P. M., 1975. Notes on tidal anticipation and migration in *Gammarus duebeni* Lilljeborg. *Can. J. Zool.*, 53 (8): 1179-1180.

Hourly samples of *Gammarus duebeni*, taken upstream of a concrete obstruction to active invertebrate movement from the tidal reach of a river, indicated that the species undergoes tidal migration. Before a change in the tide, *G. duebeni* began migration in anticipation of a rapid increase in the conductivity of the river.

NYE J. F., 1975. The use of ERTS photographs to measure the movement and deformation of sea ice. *J. Glaciol.*, 15 (73): 429-435.

Is it justified to adopt a two-dimensional continuum model for the movement and large-scale deformation of pack ice? A preliminary study of ERTS-I photography shows that the details of the ice movement are readily measurable; the problem is not in the accuracy of the remote sensing but in the inherent graininess of the sea ice. There is a spatial variation of ice velocity on a scale of several hundreds of kilometres; smaller-scale variations are superimposed on this, but their amplitude is not enough to obscure the large-scale trend. A continuum model is applicable, but, because of the small-scale variations in the velocity of the sea ice itself, it is not meaningful to specify continuum strain-rates on a scale of, say, 100 km to more than a certain accuracy. If ERTS pictures are available during the AIDJEX main experiment they could provide the necessary strain and displacement measurements for comparison with the predictions of the AIDJEX model.

NYE J. S., 1975. Ocean rule making from a world politics perspective. *Ocean Dev. int. Law J.*, 3 (1): 29-52.

The issue of ocean space and resources has a distinguishable political system. The classic norms governing this political system were based on the principle of "freedom of the seas." In the last half-century, weakening adherence to that principle is a basis for distinguishing three eras: a strong regime up to 1945, a strong quasi-regime from 1946 to 1966, and a weak quasi-regime since 1967. Change in the structure of military power, long a favorite index of political analysis, does not adequately explain the changes in ocean regimes. Unlike the days of British hegemony there is currently an incongruity between overall military power and influence in ocean politics. This incongruity is a combined result of (1) military bipolarity, (2) changes in the role of force and of international organizations, (3) the inability of the United States to pursue a consistent hegemonial strategy in the face of complex domestic interests and the transnational activity of important groups. Hegemony is no longer a sufficient approach to the politics of ocean rule making.

OHWADA MAMORU, 1975. Vertical distribution of diatoms in the Sea of Japan. *Bull. Maizuru mar. Obs.*, 13: 19 pp.

The hydrography and vertical distribution of diatoms in the Sea of Japan in winter, summer, and autumn, 1969 were studied. Dead cells were distinguished from living ones by their external appearance under a microscope.

Stability of the water column and vertical mixing of water control the maximum depth living diatoms can reach. Living diatoms reach 300 m depth in winter in the Liman cold water area where the stability is small and vertical mixing is easy, while living diatoms are limited to levels shallower than 100 m in summer and autumn, because vertical mixing is restricted by the stability. In the coastal area, living diatoms reach the bottom at 200 m or 300 m in all seasons, because of the turbulence caused by the undulating bottom topography.

The density and the species composition of living diatoms are nearly uniform vertically in winter. In summer, there are two population maxima. The upper appear above the pycnocline, while the lower maxima develop below it. In autumn, the population maxima are complex, but they occur at the upper level of the thermocline.

There are many species that prefer the surface layers with high temperatures and intense light in the coastal waters and the Tsushima Warm Current, but most species in the Liman cold water and frontal zone prefer the sub-surface waters with low temperature and less light.

OLSSON INGEMAR, 1975. On methods concerning marine benthic meiofauna. *Zoon*, 3 (1): 49-60.

Data concerning a comparative test on the Swedish west coast with two modified Högland corers and Scuba-collected cores are given. It is concluded that the observed differences in abundances for different benthic, meiofaunal units between the tools used are primarily biologically and not methodologically based. Only Podoplea (Harpacticoida and Cyclopidea) showed, however, significantly deviating values (transformed values). Comparative tests with a suction sampler and with a multiple tube corer are also presented. Results from subsampling with a small sample divider for meiofauna are presented. Different aspects are given on the meiofauna retained by a 0.2 mm mesh, compared with the information given when a 0.1 mm mesh is also included in the analyses. Treated variables are abundances, weights, number of foraminiferan species, foraminiferan diversity and redundancy. In nearly all cases the parameters in the two sieve categories were significantly correlated, laying a basis for the conclusion that the 0.2 mm fraction well reflected the meiofauna in the 0.1 mm mesh.

ORLIN HYMAN, 1975. Offshore boundaries: engineering and economic aspects. *Ocean Dev. int. Law J.*, 3 (1): 87-96.

The document delimiting offshore boundaries should consider the engineering problems inherent in demarcation and recovery. A discussion of these problems and the estimated 1975 costs for implementation of a boundary are discussed. The need for precise language, based upon present technology requiring engineering input, is of paramount importance to the development of a practical agreement.

PASCIAK W. J. and JEROME GAVIS, 1975. Transport limited nutrient uptake rates in *Ditylum brightwellii*. *Limnol. Oceanogr.*, 20 (4): 604-617.

The analysis of diffusional transport limitation of nutrient uptake rates by phytoplankton, derived earlier for spherical cells is extended to include, in an approximate manner, cylindrical and disk-shaped cells. Transport limitation of nutrient (NO_3^- and NO_2^-) uptake rates by the marine diatom, *Ditylum brightwellii*, was demonstrated experimentally at low nutrient concentrations in quiescent media. The effect of transport limitation was decreased by mixing and eliminated completely when the organism was cultured in a medium being sheared at a high enough rate. It also disappeared at high enough nutrient concentrations.

PATEL K. S., 1975. The relationship between yeasts and marine algae. *Proc. Ind. Acad. Sci.*, (B) 82 (1): 25-28.

Actively growing algae contain smaller number of yeasts per g of algae than yeasts present per ml of surrounding sea-water in Gopnath coast, Gujarat. But when the algae start decomposing yeast per g of algal material increases and yeast per ml of sea-water decreases.

PĘCZERZEWSKI KAZIMIERZ, 1974. The content and distribution of organic C in the superficial layer of bottom sediments in southern Baltic. (In Polish; English abstract.) *Zesz. nauk. Wydz. Biol. Nauk Ziemi, Oceanografia*, 1974 (2): 5-21.

The content of C_{org} and nitrogen in 171 samples of bottom sediments from southern Baltic was determined by gas chromatography. An analysis of the data relating to the content of C_{org} , nitrogen and phosphorus in the superficial layer of bottom sediments for the Deep of Bornholm, the Trough of Słupsk and the Deep of Gdańsk, has revealed a considerable diversification of these elements, and of the ratios investigated: C/N, C/P and N/P.

PENN J. W. and R. W. STALKER, 1975. A daylight sampling net for juvenile penaeid prawns. *Aust. J. mar. Freshwat. Res.*, 26 (2): 287-291.

A sampling device capable of capturing buried juvenile penaeid prawns has been constructed and tested. The towed sampling net described utilizes pumped water jets to disturb buried prawns from the upper 3 cm of sediment whilst they are within the net covered sled. The jets also generate a turbulent flow of water, which together with the forward movement of the sled, carries the animals back into the pocket of the net. Data on the catch rates and sizes of prawns caught are presented, with a discussion of the efficiency of the apparatus and its use as a quantitative sampling device.

PERES J. M. et J. PICARD, 1975. Causes de la raréfaction et de la disparition des herbiers de *Posidonia oceanica* sur les côtes françaises de la Méditerranée. *Aquat. Bot.*, 1 (2): 133-139.

After a short review of the special features and ecological requirements of *Posidonia* beds on the Mediterranean coast of France, the authors point out the impressive decrease, during the last 25 years, of the areas inhabited by this seagrass in the Gulf of Marseilles. Two different causes which also represent two different stages of the adulteration have been observed. The first one is the increase

in the level of global pollution, mainly from sewage, which resulted in an increase of the turbidity of the seawater through eutrophication processes and induced the compensation depth to decrease by about 5 - 8 m. Thus the deepest parts of the beds progressively disappeared in the years 1948 - 1955.

The second cause may be related to the general increment of the clay sedimentation in the Gulf, which arose from the harnessing of the Rhône. Formerly this river had strong floods, especially in spring but sometimes also in autumn, which dispersed all the finest particles. Since the harnessing has been completed to provide as much hydroelectric power as possible, such floods are very rare and weaker than previously. Thus, larger and larger quantities of clay are transported towards the western parts of the Gulf of Marseilles by the coastal countercurrent arising from the Rhône delta. Recently, it has been demonstrated that some clay minerals strongly adsorb some anionic detergents when suspended in sea water and later desorb them in the interstitial water. Comparison of shallow water *Posidonia* beds submitted to a high sedimentation rate of clay in unpolluted and polluted areas reveals that impoverishment and finally disappearance of *Posidonia* beds and their associated organismic assemblage, only occurs in areas which are polluted by domestic sewages containing detergents, and this does not happen in places where bottom currents are strong enough to prevent high rates of clay sedimentation.

Disappearance of *Posidonia* beds is probably not very important as far as the input of particulate and dissolved organic matter is concerned; but adulteration of these beds results in a decrease of shelter, food resources, spawning and nursery areas, etc. which are useful for many nectobenthic species, specially fishes. Moreover, the lack of detrital material (rhizomes, leaves, fibers) which normally arises from *Posidonia* beds may induce important changes of some other shelf biotopes and their associated fauna.

PERESLEGIN S. V., 1975. Statistical characteristics of sea surface microwave back-scattering taking into account the finite resolution and depolarization effect. (In Russian; English abstract.) *Fiz. Atmosf. Okeana, Izv. Akad. Nauk, SSSR*, 11 (6): 610-619.

Dispersions and the fluctuation intervals of sea waves' slopes, as observed by an electromagnetic device with finite resolution, are calculated. Then the correlation between the fluctuations of radar scattering and those of the slopes is considered; and, finally, three-dimensional scattering patterns and their major polarization components are analyzed.

PERRY W. J. Jr., J. P. MINARD, E. G. A. WEED, E. I. ROBBINS and E. C. RHODEHAMEL, 1975. Stratigraphy of Atlantic coastal margin of United States north of Cape Hatteras—brief survey. *Am. Ass. Petrol. Geol. Bull.*, 59 (9): 1529-1548.

A synthesis of studies of sea-floor outcrops of the sedimentary wedge beneath the northeastern United States continental shelf and a reassessment of coastal plain Mesozoic stratigraphy, particularly of the coastal margin, provide insight for estimating the oil and gas potential and provide geologic control for marine seismic investigations of the Atlantic continental margin.

The oldest strata known to crop out on the continental slope are late Campanian in age. The Cretaceous-Tertiary contact along the slope ranges from a water depth of 0.6 to 1.5 km south of Georges Bank to 1.8 km in Hudson Canyon. Few samples are available from Tertiary and Late Cretaceous outcrops along the slope.

Sediments of the Potomac Group, chiefly of Early Cretaceous age, constitute a major deltaic sequence in the emerged coastal plain. This thick sequence lies under coastal Virginia, Maryland, Delaware, southeastern New Jersey, and the adjacent continental shelf. Marine sands associated with this deltaic sequence may be present seaward under the outer continental shelf. South of the Norfolk arch, under coastal North Carolina, carbonate rocks interfinger with Lower Cretaceous clastic strata.

From all available data, Mesozoic correlations in coastal wells between coastal Virginia and Long Island have been revised. The Upper-Lower Cretaceous boundary is placed at the transition between Albian and Cenomanian floras. Potential hydrocarbon source beds are present along the coast in the subsurface sediments of Cretaceous age. Potential reservoir sandstones are abundant in this sequence.

PERSON-LE RUYET JEANINE, 1975. Élevage de Copépodes Calanoïdes. Biologie et dynamique des populations: Premiers résultats. *Ann. Inst. océanogr., Paris*, (N.S.) 51 (2): 203-221.

Four species of planktonic Calanoid Copepods, *Acartia clausi*, *Centropages typicus*, *C. hamatus* and *Temora longicornis*, were cultured during one year, at 20°C, with the green alga *Tetraselmis suecica*. Generation time and reproductive rate were investigated; the best results are obtained with *C. hamatus* and *A. clausi*: 50 and 60 adults per female, per cycle (20 and 21 days).

The relationship between grazing and the size and density of some algae is briefly investigated. Algae of 5 to 25 μ were filtered; the ingestion rate increases with the food density. The effect on culture production has still to be studied.

PETERSON W. T. and C. B. MILLER, 1975. Year-to-year variations in the planktology of the Oregon upwelling zone. *Fish. Bull., Nat. mar. Fish. Serv., U. S.* 73 (3): 642-653.

Sampling results from Oregon coastal waters show that plankton abundance in 1971, a year of reduced coastal upwelling, was lower than in 1969 or 1970. This correlated with greater frequency and abundance in 1971 of species usually found more offshore and with a general reduction in the number and density of the most strictly neritic species. These changes may be related to changes in nearshore fisheries which, therefore, appear to depend upon the general stimulation of production by upwelling.

PHILLIPS J. D., H. S. FLEMING, R. H. FEDEN, W. E. KING and R. K. PERRY, 1975. Aeromagnetic study of the Mid-Atlantic Ridge near the Oceanographer Fracture Zone. *Geol. Soc. Am. Bull.*, 86 (10): 1348-1357.

An aeromagnetic study was conducted over the Oceanographer Fracture Zone on the Mid-Atlantic Ridge between 33° to 37°N and 31° to 39°W. A sea-floor-spreading interpretation of the magnetic anomalies reveals that the ridge crest is formed of short, en echelon segments 40 to 60 km long. These segments are offset by transform fractures. An average spreading rate of about 1.1 cm/yr active over the last 10 m y can be fitted to the ridge crest anomalies 2' through 5. However, positive identification of the outer flank anomalies is not possible. The ridge crest anomalies younger than 7 m y old (anomaly 4) show a general trend of N30°E, but anomalies between 9.3 and 17.5 m y old (anomaly 5 to 5') have trends of about N8°E. The oldest flank anomalies (anomaly 6) trend about N35°E. Application of the anomaly trend superposition technique to account for the offset anomaly and fracture-zone pattern has allowed a new calculation of rotation pole parameters for the North American-African plate systems. For anomaly 2' (2.7 m y ago), the finite rotation pole is located south of Iceland at 58.8°N, 17.4°W, with an angular rotation of 1.26°. For anomaly 5 and the older flank anomalies 5' and 6, the finite rotation poles are located near Svalbárd at 78.6°N, 34.5°E; 80°N, 29.9°E; and 80°N, 46.1°E, with angular rotations of 2.67, 3.84, and 4.64 degrees, respectively. The major change in the pole location between anomalies 2' and 5 about 7 m y ago appears to have been accompanied by the creation of a new transform fracture pattern with old fractures terminating and new ones being formed. Comparison of the two general pole locations deduced here with poles determined by others for the earlier opening history of the North American-African plate system shows that all finite poles lie in either of these locations. This suggests that a bi-stable dynamic equilibrium condition has prevailed throughout the opening history, with the rotation poles being located south of Iceland during the earliest period (200 to 80 m y ago) and the latest period (~ 7 m y ago to the present) of opening. During the intervening period, the poles were located near Svalbárd.

PIECHOTA WERONIKA, 1974. The biology and ecology of the sea-floor Crustacea of the southern Baltic. [*Mesidothea entomon*.] (In Polish; English abstract.) *Zesz. nauk. Wydz. Biol. Nauk Ziemi, Oceanografia*, 1974 (2): 91-107.

Mesidothea entomon, an arctic relict, is a common inhabitant of the southern Baltic. It appears to be more abundant in the south-eastern than in the southwestern Baltic, because it is a deep-water animal occurring mainly in the low-temperature zone. It does not occur in the Deep of Gdańsk (western Baltic), as this brackish-water species avoids high salinity. Its oxygen requirements are low. The preferred ground is sandy mud or fine-grained sand, rich in organic remnants on which it feeds. *Mesidothea entomon* is the largest of all the sea-floor crustacean species studied. Males are larger than females. There is a close correlation between the body-length and body-weight of *Mesidothea entomon*. The type of substratum and the body-weight of this species are related, as the average body-weight of an individual *Mesidothea entomon* increases over the line: gravel-sand-mud. Reproduction of *Mesidothea entomon* occurs throughout the year; this process is most intense in the summer months and at the beginning of autumn. Seasonal migratory behaviour was observed.

PINKEL ROBERT, 1975. Upper ocean internal wave observations from *Flip*. *J. geophys. Res.*, 80 (27): 3892-3910.

Profiles of temperature versus depth in the top 440 m of the sea were taken repeatedly at three horizontal locations surrounding the research platform *Flip*. The time fluctuation of the temperature profiles was used to determine isotherm displacement and slope variation in the region 60-400 m. Measurements were taken during three *Flip* operations. Two were off the California coast in November 1972 and June 1973. The third was north-northwest of Hawaii in November 1973. Horizontal and vertical coherence measurements indicate that the internal wave field can be divided into two frequency regions. Above 2 cph the bandwidth of energetic horizontal and vertical wave numbers is comparatively narrow. The isotherm displacement spectrum and slope spectrum have irregular slopes. A comparison of the two spectra indicates that first mode is strongly dominant. Below 2 cph the bandwidth of energetic wave numbers is broader, corresponding to multiple energetic modes. The displacement spectrum has an Ω^{-2} frequency dependence down to about 2 cpd. The slope spectrum has an approximate $\Omega^{-1/2}$ spectral form in this region. This indicates that the bandwidth of energetic horizontal wave numbers decreases with decreasing frequency, corresponding to a bandwidth of vertical wave number approximately constant with frequency. A vertical spectral analysis of the data substantiates this general picture, while it reveals the presence of a low-frequency high-mode region of surprising spectral intensity. This region might be the spectral signature of horizontally advecting features in the temperature field which are not necessarily associated with vertical density perturbations. However, estimates of horizontal wave number indicate that these features, as well as those of longer wavelength, tend to satisfy the linear internal wave dispersion relation.

POKUDOV V. V. and V. P. TUNEGOLOVETS, 1975. The heat balance of the Japan Sea at the beginning of spring warming. (In Russian; English abstract.) *Met. Gidrol.*, 1975 (3): 74-84.

The heat balance of the sea surface as well as heat transport by currents are studied on the basis of observations along sections uniformly distributed over the Japan Sea area and carried out during the second half of March 1974. By the end of March in the western portion of the sea the radiation component is the most significant part of the heat balance, while in the eastern portion of the sea heat losses by sea due to evaporation are the most significant. Spring warming commences at first in the western and southern portions of the sea.

POULIN A. O., 1975. Significance of surface temperature in the thermal infrared sensing of sea and lake ice. *J. Glaciol.*, 15 (73): 277-283.

Thermal infrared sensing can provide much information about sea ice, and some of the physical conditions associated with sea ice suggest that surface temperature may be a good indicator of ice thickness. However, steady-state heat-flow calculations suggest that the variable thickness of the snow cover and its, low, variable thermal conductivity would preclude the use of surface temperature alone as a suitable indicator of ice thickness. Measurements of surface temperature, snow depth, and ice thickness suggest that, in an area of relatively uniform ice thickness, surface temperature might be useful as an indicator of snow depth if some surface data can be obtained.

PRANDLE D., 1975. Storm surges in the southern North Sea and River Thames. *Proc. R. Soc. Lond.*, (A) 344 (1639): 509-539.

A numerical model has been formulated to provide predictions of surge levels in the southern North Sea and River Thames. The model has been used to simulate the disastrous surge of January–February 1953. It is shown that the major surge component along the east coast of England was that propagating from the northern North Sea, whereas along the Dutch coast the major component was due to the wind effect over the southern North Sea. During the course of the storm there was a large net transport of water southwards through the Dover Strait. This residual flow was found to affect the surge levels at Southend.

An investigation has been made of the effect of deploying the future Thames Barrier during the course of the storm. At Southend the amplitude of the reflected wave from the barrier was found to be negligible.

The distribution of energy during the storm has been examined and a plot made of the spatial variation in energy dissipation by bed friction.

PRASAD KANTI and D. K. RAO, 1974. Case studies of westerly waves in the development of monsoon depressions. *Indian J. Met. Geophys.*, 25 (2): 265-268.

Development of monsoon depressions forming on 3 and 12 August 1972 in the north Bay of Bengal was found to be linked with changes in mid-latitude upper tropospheric flow patterns over China and adjoining areas. Development took place in association with upper tropospheric cut-off lows which formed over China, retrograded and induced perturbations in the easterlies over the head of the Bay of Bengal.

PUGH D. T., 1975. Deep-sea temperature variations and their influence on heat-flow measurements. *Earth planet. Sci. Letts*, 27 (2): 121-126.

Deep-sea measurements of geothermal heat flow sometimes show a larger scatter within an area than is usual for continental measurements. Accurate records of deep-sea (greater than 4,500 m) temperatures, near the sea floor, are used to show that these local variations in heat flow are unlikely to be due to temperature variations in the bottom water. Temperature measurements made at shallower depths over extended periods, by gauges deployed for tidal studies, are also considered. At two stations (2,200 and 3,022 m) monthly temperature changes would produce significant gradients to a depth of 1 m into the sediments. Longer-period temperature variations can affect measured heat flow to much greater depths of penetration, and present evidence is insufficient to exclude the possibility.

RATKOWSKY D. A., T. G. DIX and K. C. WILSON, 1975. Mercury in fish in the Derwent Estuary, Tasmania, and its relation to the position of the fish in the food chain. *Aust. J. mar. Freshwat. Res.*, 26 (2): 223-231.

Total mercury concentrations are reported for 258 individuals representing 16 species of finfish from the Derwent Estuary, Tasmania. Mercury concentrations in the muscle tissue varied between undetectable levels and a value of 2.0 mg/kg in one specimen of a species of shark. Irrespective of species, the area encompassing Ralphs Bay contained a higher percentage of fish with mercury concentrations in excess of the Tasmanian Food Regulation limit of 0.5 mg/kg than any other area of the Estuary. Ralphs Bay is the area in which oysters were found in a previous study to contain extraordinarily high concentrations of other heavy metals, particularly zinc, cadmium and copper.

The fish's position in the food chain appeared to be an important factor determining its mercury content. Approximately 51% of individual fish of species whose diet consists predominantly of other fish had mercury concentrations in excess of 0.5 mg/kg. In contrast, 24% of invertebrate predators and only 7% of individuals of herbivorous habit had mercury concentrations in excess of 0.5 mg/kg.

RAYNOR G. S., PAUL MICHAEL, R. M. BROWN and S. SETHURAMAN, 1975. Studies of atmospheric diffusion from a nearshore oceanic site. *J. appl. Met.*, 14 (6): 1080-1094.

A research program is in progress at Brookhaven National Laboratory to determine the nature of atmospheric diffusion from a representative oceanic site, to relate observed diffusion patterns to meteorological and oceanographic variables, and to develop models to describe such diffusion. The program was initiated in response to plans for construction of offshore nuclear power plants.

Tracer experiments are conducted utilizing oil-fog smoke released from a boat stationed from 1 - 3 mi offshore during onshore flows. The smoke is photographed from above and from the side to document lateral and vertical spread. The crosswind concentration distribution is measured by vehicle- and boat-mounted densitometers during successive traverses across the plume. Wind, turbulence and temperature at several levels are measured on the beach by tower-mounted instruments. Temperature profiles at greater heights are measured by kytoon- and aircraft-borne sensors. Water temperatures are also measured. Winds aloft are determined by pibal ascents and turbulence at various altitudes is sampled by an aircraft-mounted variometer.

Preliminary results show that diffusion is governed primarily by water and air temperature differences. With colder water, low-level air is very stable and diffusion minimal but water warmer than the air induces vigorous diffusion. Measurements of plume width and height have been obtained which are smaller and of normalized concentration which are larger than those predicted for the Pasquill F category. Measured values of plume width can be predicted from Eulerian measurements at the beach.

RAZOULS CLAUDE, 1974. Estimation de la production globale des Copépodes planctoniques dans la province néritique du Golfe du Lion (Banyuls-sur-Mer). I. Variations annuelles quantitatives. *Vie Milieu*, (B) 24 (2): 257-280.

The cycles of numerical variation of planktonic copepods sampled with two Hensen nets of different mesh size, 0.330 and 0.160 mm are very similar although the fishing capacity of the former is much higher. Total numbers follow a cycle characterized by the alternation of distinct minima and maxima which result from the successions of generations of dominating species. We found four to five periods of great abundance: January - February, March - April, May - June, September - October. The minima are found in August and December. The amplitude of the mean quantitative annual variations varies from 18,500, or 930 per m³, to 142,400, or 7,120 per m³, copepods per haul, 0.41 m² surface in the neritic province.

REED R. K., 1975. Variations in oceanic net long-wave radiation caused by atmospheric thermal structure. *J. geophys. Res.*, 80 (27): 3819-3820.

Observations of clear sky net long-wave radiation at sites off Oregon and off northwest Africa were compared with vertical profiles of air temperature. Atmospheric thermal inversions appeared to reduce the net long-wave radiation by at least 0.02 cal cm⁻² min⁻¹. If empirical formulas are used to estimate the irradiance, account should be taken of this effect in regions with persistent inversions.

RESNYANSKY Yu. D., 1975. On the parametrization of the integral turbulent energy dissipation in the upper ocean quasi-homogeneous layer. (In Russian; English abstract.) *Fiz. Atmosf. Okeana, Izv. Akad. Nauk, SSSR*, 11 (7): 726-733.

A possibility is considered of using the similarity theory for the parametrization of the integral turbulent energy dissipation D in the upper ocean quasi-homogeneous layer. A formula is obtained relating the dissipation D to the parameters determining the turbulent regime. This formula is free of some shortcomings typical to previous methods of dissipation parametrization. The solutions of the equation set describing the thermodynamic processes in the non-stationary quasi-homogeneous ocean layer are obtained. On the basis of the analysis of these solutions, conclusions are drawn on the role of the non-stationary factors in forming the vertical thermal structure of the upper ocean layer during the periods when its surface is heated or cooled.

REZANOV I. A. and A. Sh. FAYTEL'SON, 1975. Formation of oceanic crust. *Int. Geol. Rev.*, 17 (8): 886-888. Translated from: *Vyssh. Ucheb. Zaved. Izv., Geol. Razved.*, 1974 (2): 13-15.

Oceanization of continental crust, now in progress in the Pannonian depression (Hungary), in parts of the Mediterranean and in the seas of Japan and Okhotsk, is essentially a fractionation by smelting, in line with Vinogradov's theory. Partial melting of ultrabasic substance in the mantle yields basalts under certain conditions. Further desilicification and dealcalization of basalts, at higher levels in the crust, liquifies and liberates the rhyolite-andesite fraction, and so on. The end product of such fractionations, i.e., partings of silica, hydrotherms, volatiles, alkalies, in one form or another, is a relatively thin crust, the bulk of which is a refractory residue, in fact "oceanic", overlain by a thin layer of its acidic derivatives.

ROBERTS D. G., 1975. Sediment distribution on the Rockall Bank, Rockall Plateau. *Mar. Geol.*, 19 (4): 239-257.

Rockall Bank is an unusual example of an isolated continental shelf developed on the subsided Rockall Plateau microcontinent. The sediment distribution on Rockall Bank has been investigated using topographic, seismic, sonar and photographic data. The present sedimentation regime may reflect post-Flandrian transgressive burial of the older substrate. The limited development of the shelf reflects the lack of sediment supply available on Rockall Bank which, with the exception of glacial periods, has probably been submerged for the past 37 m y.

ROCHFORD D. J., 1975. Nutrient enrichment of east Australian coastal waters. II. Laurieton Upwelling. *Aust. J. mar. Freshwat. Res.*, 26 (2): 233-243.

An oceanographical investigation of coastal waters off Laurieton, N. S. W. (31°39'S.) during August 1968 to March 1974 has shown that upwelling was a regular feature of the spring and summer season. This upwelling was confined to a 5-mi zone against the coast, occurred at intervals between 12 and 57 days, was of short duration (9-15 days complete cycle) and originated in offshore 15-17°C

waters around 125-275 m depth. Upwelling velocities during the final stages of development were between 17 and 34 m per day. Causes of the upwelling could not be determined. However, it is possible that the narrowing of the shelf width just north of Laurieton is a local factor of importance.

RODERICK G. L., 1975. Electroosmotic reduction of ocean bottom breakout forces and times. *Can. geotech. J.*, 12 (3): 289-295.

Laboratory model pullout tests were conducted with a cylindrical object, 1 sediment, 1 object *in situ* time, 3 electrode configurations, and electric potential gradients of 0, 0.25, and 0.5 V/cm to determine the effect of electroosmosis on reducing force and time requirements for breaking objects free of soft sediments.

Results show electroosmosis to be very effective in reducing breakout times. The relationship between the breakout force ratio and breakout time can be expressed in terms of 2 empirical parameters. Electrical power requirements to achieve breakout appear to be independent of electrode configurations but do depend on electric potential gradients.

ROPER C. F. E. and R. E. YOUNG, 1975. Vertical distribution of pelagic cephalopods. *Smithson. Contr. Zool.*, 209: 51 pp.

Vertical distributions of pelagic cephalopods are analyzed, based primarily on studies undertaken in the waters off California, Bermuda, and Hawaii. Much of the information derives from samples taken in midwater trawl nets equipped with closing apparatus. Each family that contains pelagic or quasi-pelagic species is discussed; selected records from the literature are included where necessary.

A wide variety of patterns of vertical distribution exists among pelagic cephalopods; patterns may be associated with stage of maturity, diel rhythms, or seasonal behaviour. The study revealed that a number of vertical distribution patterns occur: near-surface dwellers, first order diel vertical migrators, second order diel vertical migrators, diel vertical shifters, diel vertical spreaders, non-migrators, vertical wanderers, species associated with the ocean bottom, and species exhibiting ontogenetic descent.

RUDDIMAN W. F. and L. K. GLOVER, 1975. Subpolar North Atlantic circulation at 9,300 yr BP: Faunal evidence. *Quat. Res.*, 5 (3): 361-389.

We have examined the circulation of the subpolar North Atlantic at 9300 yr BP by using a dispersed layer of silicic volcanic ash as a synchronous horizon. At the level of this datum, we have reconstructed from foraminiferal evidence a geologically synoptic view of seasonal variations in sea-surface temperatures and salinities. The reconstruction defines two oceanic fronts at 9300 yr BP:

(1) the meridionally oriented Polar Front bordering the axis of deglacial outflow of Arctic and Laurentide ice and meltwater and (2) a zonal portion of the Subarctic Convergence along 48° N, marking a major confluence between the subtropical and subpolar gyres. The 9300-yr configuration primarily differed from the modern pattern in the more easterly position, by 3°, of the Polar Front and the more southerly, 3°, and easterly, 5°, position of the Subarctic Convergence. Both fronts had been merged at 18,000 yr BP into the full-glacial Polar Front; at 9300 yr BP, they were approaching the end of a northwestward deglacial retreat toward the modern interglacial positions.

There were two dominant departures at 9300 yr BP from the Earth's modern configuration, both related to deglaciation: the very large Laurentide Ice Sheet still covering eastern North America to 48° N, and the region of cold Arctic/Laurentide deglacial outflow. These two features caused: (1) a more easterly position than now exists of the region of upper air divergence and lower air convergence downstream from the Ice Sheet and meltwater outflow; (2) a more intense expression of this upper air divergence and lower air convergence over the central portion of the subpolar North Atlantic; and (3) a latitudinally more stable axis of convergence of surface westerlies over this region. These factors apparently caused the stronger oceanic convergence along 48° N than occurs at present. They also created a stronger, southeastward-directed wind drift current, which opposed the meridional (northward) flow typical of the present interglaciation.

RUSBY J. S. M. and J. REVIE, 1975. Long-range sonar mapping of the continental shelf. *Mar. Geol.*, 19 (4): M41-M52.

Recent experiments in the shallow waters of the continental shelf off the west coast of Scotland have shown that it is possible to obtain geologically useful sonographs from a towed low-frequency side-scan sonar (GLORIA project) out to long ranges. Frequency-modulated pulses of 2-sec duration, centred at 6.4 kHz, with an acoustic power of 10 kW were transmitted, and the received energy was processed by a linear correlator. A maximum range of 13 km was achieved under both isothermal and stratified water conditions; however the most even irradiation of the sea floor was obtained when the water was isothermal, and under stratified conditions the maximum range could be reduced to 5 km or less if the sonar array was towed at a depth which lay within any strong temperature gradient in the water column.

Examples of isometric records are shown, and it is suggested that mosaics could be built up from such records, obtained at a coverage of 170 km²/hour.

RZHEPLINSKY G. V., G. V. MATUSHEVSKY and L. A. YESHCENKO, 1975. Unusual swell waves. (In Russian; English abstract.) *Met. Gidrol.*, 1975 (3): 68-73.

On the basis of field measurement data, derived at the Caucasus coast of the Black Sea, a new source of large swell waves—fluctuations of the near-surface atmospheric pressure in the zone of a cold front, moving over the sea, is revealed. Characteristics of these "frontal" waves (spectra, heights, periods) are shown as well as theoretical considerations about the resonance mechanism of their generation are described.

SAGAI DACHNY A. Yu., 1975. Distribution and some biological features of *Halobates* (Hemiptera, Gerridae) in the Indian Ocean. (In Russian; English abstract.) *Okeanologiya*, 15 (2): 307-312.

The distribution of two common water-striders, *Halobates*, in the Indian Ocean is considered, and breeding seasonality of one of them is analyzed. The material was collected during the 31st, 33rd, 35th, 41st and 54th cruises of the R/V *Vityaz* in 1959 - 1973. Two species have been found in the samples: equatorial *H. micans* and neritic *H. germanus*. *H. micans* inhabits the waters with temperature above 20 - 21°C during the coldest part of a year. The factors controlling the distribution of *H. germanus* seem to be the supply of food, i.e., insects from the land, as well as the absence of substratum for eggs incubation. The abundance and the sizes of adult specimens of *H. micans* are related to the abundance of plankton. The breeding of the species is most intensive in April, July and December.

SAINT-GUILY B., 1974. Sur la perturbation thermique produite en mer par en jet d'eau chaude. *Vie Milieu*, (B) 24 (2): 223-234.

The increase of temperature due to the pouring of warm water into the sea is analysed by considering three distinct models: a divergent jet with diffusion, a divergent jet with diffusion and atmospheric cooling, and a strong narrow jet with diffusion. Tidal and other currents are regarded as negligible. This study shows that the jet effect, the marine diffusion, and the atmospheric cooling are dominant respectively, near the mouth, in an intermediate zone and far from the mouth of the jet.

SAINT-GUILY BERNARD, 1975. Effets de la composante horizontale de la rotation terrestre sur les mouvements dans une mer homogène. *Ann. Inst. océanogr.*, Paris, (N.S.), 51 (2): 135-142.

Effects of the horizontal component of the earth's rotation on motions in a homogeneous sea are analysed by considering two problems: wind induced currents in a permanent regime, and free periodic waves. Generally, the influence of the horizontal component of rotation is related to the presence of north-south gradients of the applied forces and of velocity components. In the first problem, if the depth is sufficiently great, the internal vertical circulation is divided into several superposed cells. In the second problem, the inclination of the rotation axis intervenes so as to widen the frequency band of the internal waves. The limit frequencies greatly depend on the ratio of the depth to the wave length and, particularly near the Equator, on the direction of propagation of these waves.

SANFORD T. B., 1975. Observations of the vertical structure of internal waves. *J. geophys. Res.*, 80 (27): 3861-3871.

Velocity profiles in the open ocean reveal variations in the current structure throughout the water column. Superimposed on a smooth low-frequency shear profile are many layers of large time-variable shear. Repeated profiles at one location show that the time-dependent structure is dominated by rotary currents of diurnal-inertial period. Coherence calculated between profiles lagged in time indicates downward energy propagation. The kinetic energy of these internal waves varies with depth in a manner similar to that of the Brunt-Väisälä frequency, but over a brief series of profiles there can be localized zones which are more energetic than might be expected. Based on velocity shear measured over 10-dbar intervals and a time mean Brunt-Väisälä profile. Richardson numbers between ½ and 4 are observed over much of the water column. Simultaneous profiles are most similar at a separation of 100 m, gradually becoming more different for larger separations of up to 10 km.

SARKISYAN A. S. and A. STASKIEWICZ, 1975. Calculations for the winter circulation in the North Atlantic. (In Russian; English abstract.) *Met. Gidrol.*, 1975 (4): 62-70.

Results from calculations of water circulation in the North Atlantic using data of a given density field for the winter season with a grid with a 2.5° steps are shown. When compared with results of similar calculations with a step two-folds less, it is apparent that for a deep ocean description of large-scale circulation, the utilization of a calculation grid with a step of 2-3° is adequate. Such a procedure allows economy in computer memories.

SARUHASHI KATSUKO, YUKIO KATSURAGI, TERUKO KANAZAWA, YUKIO SUGIMURA and YASUO MIYAKE, 1975. ⁹⁰Sr and ¹³⁷Cs in the Pacific waters. *Rec. oceanogr. Wks Japan*, (N.S.) 13 (1): 1-15.

Secular changes in ⁹⁰Sr and ¹³⁷Cs contents in the Pacific waters have been studied since 1957. In surface water ⁹⁰Sr and ¹³⁷Cs which were mainly derived by the Castle Test in 1954 decreased from a few pico curie per liter in 1957 to 0.2-0.5 pico curie per liter in 1961. The second maximum appeared in 1964 due to the stratospheric fallout originated in 1961 - 62 tests. The difference in concentration between the west and east in the North Pacific decreased year by year and the same level of concentration was observed in 1962, 8 years after the Castle Test.

In the vertical direction, ⁹⁰Sr and ¹³⁷Cs reached down to six thousand meters in 1959 which suggested the rapid penetration of these nuclides down to the deep. During the period from 1968 to 1972, the determinations of ⁹⁰Sr and ¹³⁷Cs were done in the entire Pacific.

Results showed that the higher values both in the surface and deep were observed in the North than the South Pacific which were mainly due to the difference in the fall rate of these nuclides between the two hemispheres.

SAUNDERS K. D. and R. C. BEARDSLEY, 1975. An experimental study of the spin-up of a thermally stratified rotating fluid. *Geophys. Fluid Dynam.*, 7 (1): 1-27.

A simple model of the spin-up of a continuously thermally stratified rotating fluid is examined experimentally. The geometry of the system consists of a right circular cylinder bounded on the top and bottom by perpendicular planes. The cylinder contains a linearly stratified fluid, initially rotating in solid body rotation with an angular velocity $\Omega(1 - \epsilon)$. At time $t = 0$, the rotation rate of the boundary is changed to Ω . The adjustment of the fluid to the new angular velocity, described by Walin and others for the case of non-conducting walls, is here expanded to treat the case of a partially conducting side boundary.

Laboratory experiments testing the validity of the linear theory are discussed. The external rotational Froude number is very small, the Rossby number is $O(E^{1/2})$, and the stratification parameter $B = N/2\Omega$ is $O(1)$. The side wall conditions are shown to be effectively insulating in the framework of the expanded theory. While experiments confirm the qualitative aspects of the theory, namely spin-up in a time scale of $O(E^{-1/2} \Omega^{-1})$, measurement of the time dependent density field indicates that the first modal spin-up time is significantly shorter than predicted. Several possible causes for this observed difference between theory and experiment are discussed. While a direct comparison is impossible, the observed faster spin-up appears to be consistent with the experimental results of Buzyna and Veronis. The observed laboratory density field is also compared for one experiment with the results of the numerical model for stratified spin-up developed by Barcelon, Lau, Piacsek and Warn-Varnas (see accompanying paper).

SAYLES F. L., T. L. KU and P. C. BOWKER, 1975. Chemistry of ferromanganous sediment of the Bauer Deep. *Geol. Soc. Am. Bull.*, 86 (10): 1423-1431.

Sediment from the Bauer Deep in the east Pacific is commonly carbonate free, containing only small amounts of detrital minerals, and is enriched in Fe, Mn, Cu, Co, Ni, Zn, and Ba. An Fe-montmorillonite and ferromanganese compounds, occurring both as colloids and micronodules, are the principal phases present. A large proportion of the Fe occurs in the Fe montmorillonite, which appears to originate from the interaction of hydrothermal solutions with sea water. Adsorption and incorporation of metals from sea water on the micronodules or the Fe and Mn oxide colloids best explain the elemental relationships observed for Fe, Mn, Cu, Zn, and Ni in the oxide fraction of the sediment. These processes are responsible for the enrichment of the sediment in Ni, Co, and possibly Mn. Enrichment in Cu and Zn occurs in both the oxides and the Fe montmorillonite. Sedimentation rates measured in one core provide a minimum value of 2.5 mm/10³ yr. The rate of accumulation of authigenic material is more than 2 mm/10³ yr. Elemental accumulation rates of Fe, Mn, Cu, Ni, and Zn are comparable to those found near the crest of the East Pacific Rise.

SCHNESE W., G. SCHLUNGBAUM und O. MIEHLKE, 1973. Zu Aspekten der Küstengewässerforschung der DDR, unter besonderer Berücksichtigung der Aufgaben der Sektion Biologie der Universität Rostock und ihrem Zusammenwirken mit den Kooperationspartnern. *Wiss. Z. Univ. Rostock*, 22 (10): 1057-1065.

A short portrayal is provided of coastal water research tasks from the standpoint of the Biological Section of the University of Rostock and its research associates from the water departments and the advanced educational authorities in the GDR. The authors present the object of their research—the chain of shallow inlets to the south of Darss-Zingst (South Baltic). This contribution also contains a comprehensive bibliography of scientific papers written by the research groups at the universities of Rostock and Greifswald regarding the Baltic Sea, the coastal waters and the catchment area. The contribution serves as an introduction of the following 14 papers.

SCHNESE WERNER und FRIEDEL FISCHER, 1973. Abundanzen und Biomasse des Zooplanktons während der synoptischen Aufnahme der Bodden südlich der Halbinsel Zingst (südliche Ostsee) im Mai/Juni 1972. *Wiss. Z. Univ. Rostock*, 22 (10): 1115-1118.

During the synoptic investigation of the shallow inlets from 29 May to 3 June, 1972, 123 zooplankton samples were taken and evaluated both qualitatively and quantitatively. The mean value for the biomass fluctuated between 0.6 and 17.9 g fresh weight/l. at the four stations in the eastern part of the chain of shallow inlets to the south of Darss-Zingst (Barthe estuary and the Barther Bodden). Copepods accounted for 99% of the biomass of the zooplankton.

SHEPARD F. P., 1975. Progress of internal waves along submarine canyons. *Mar. Geol.*, 19 (3): 131-138.

Alternating up- and downcanyon currents with velocities up to 50 cm/sec are found in submarine canyons. These alternations have patterns that usually can be matched between adjacent stations in the same canyon, even where separated by as much as 16 km. The matching of curves from adjacent stations is obtained by time shifts. In 20 out of 23 comparisons, the patterns were best fitted by shifting so that a later time of arrival is indicated for the upcanyon station. This indicates that internal waves (mostly tidal in period) are advancing up the submarine canyons or rarely downcanyon. Because the data come from canyons off California, the East Coast of the United States, and the Hawaiian Islands and include depths to as much as 3,500 m, it is suggested that these canyon internal waves may be worldwide. The exceptional downcanyon advances appear to be the result of unusual canyon bathymetry, perhaps combined with unusual tides.

SHIMAMURA HIDEKI and TOSHI ASADA, 1975. T waves from deep earthquakes generated exactly at the bottom of deep-sea trenches. *Earth planet. Sci. Letts*, 27 (2): 137-142.

T waves (seismic water waves), which were generated by deep-focused earthquakes, have been found by an array of sensitive ocean-bottom seismographic observations deployed on the western Pacific basin. The points of generation of T waves have been exactly located by use of the accurate velocity of water waves known from explosions. The positions obtained are at the bottom of deep-sea trenches; however, the positions are 10-35 km ocean-side of the trench. T waves have been known to be generated by seismic waves which were transmitted from the focus to the trench bottom along the descending lithosphere. The intensity of the observed T waves implies that the Q value along the descending lithosphere is more than 4,000. The positions of T-wave generation are consistent with the 8.2- to 8.6-km/s stratified structure of the oceanic lithosphere. T waves from shallow earthquakes beneath the lower continental slope are also clearly observed by bottom seismography.

SHIONO KIYOJI, 1974. Travel time analysis of relatively deep earthquakes in southwest Japan with special reference to the underthrusting of the Philippine Sea plate. *J. Geosci. Osaka Cy Univ.*, 18: 37-59.

Travel times of P-waves from relatively deep earthquakes located in southwestern Chubu region show that a high velocity layer lies in the uppermost mantle south of the line connecting stations HD and HB in the Kii peninsula region. Both frequency distribution of apparent velocities in central Shikoku given by Oike and Kimura and travel times of seismic waves from earthquakes in the region west of Shikoku show that a high velocity layer lies below the Shikoku region and is absent in the Kii channel.

Travel times of waves from earthquakes which occur at depths of 80 and 130 km in Kyushu and travel time anomalies of teleseismic waves from a nuclear explosion calculated by Hamada and Aoki and Tada suggest the possibility that heterogeneity of seismic velocity in the uppermost mantle may be limited only within a depth range from 40 to at most 80 km.

The presented high velocity layer verifies directly that a cool oceanic plate lies beneath the Moho discontinuity and suggests that the leading edge of the underthrusting plate reaches only 150 - 200 km inland from the Nankai trough and still remains in the continental lithosphere. This suggests that Kanamori's model is applicable to the whole area of Southwest Japan.

Because relatively deep earthquakes forms an inclined seismic belt of a small scale along the Outer Zone of Southwest Japan and can be considered to represent the interaction between the continental and oceanic plates, the spatial extent of the oceanic plate beneath the regions may be inferred from epicentral distribution of these earthquakes, independently of the travel time analysis. In the Shikoku-Kii peninsula region, the leading edge inferred from seismicity is similar to that inferred from the travel time analysis.

Considering the results obtained from the travel time analysis and activity of relatively deep earthquakes, the spatial extent of the Philippine Sea plate is determined.

The spatial feature of the presented fault model for the 1946 Nankaido earthquakes, in which a fault plane extends deeper in the Shikoku region than in the Kii channel-Kii peninsula region, is similar to the shape of the underthrusting plate, although the deeper side of the fault plane does not extend so inland as the leading edge of the underthrusting plate.

There seems to be a close relationship between transcurrent movements on the Median Tectonic Line and the location of the leading edge of the underthrusting plate. Transcurrent movements are active in the area from western Shikoku to the middle part of the Kii peninsula, where the leading edge remains in the outer block south of the Median Tectonic Line and are inactive in the area from the middle part of the Kii peninsula to the Chubu region and, possibly, in the Kyushu region, where the leading edge extends inland across the tectonic line. A decoupling hypotheses proposed by Fitch is applicable only to the former case and therefore observed results on activity on the tectonic line are favorably consistent with ones expected from the relation between spatial extent of the underthrusting plate and the Median Tectonic Line. These two consistencies support the validity of the present results on the spatial extent of the underthrusting Philippine Sea plate beneath Southwest Japan.

SHORT A. D., 1975. Multiple offshore bars and standing waves. *J. geophys. Res.*, 80 (27): 3838-3840.

Field measurements of multiple offshore bar spacing were compared to theory and wave measurements to corroborate the suggestion that bar formation and spacing are controlled by standing waves in the infragravity range (0.5 - 5 min). Theoretical and experimental studies predict the reflection of progressive waves from a shoreline as standing waves. Associated drift in the bottom boundary layer is expected to produce sediment accumulation and bar formation under either the nodal or the antinodal points. Measurements of waves in the infragravity spectrum confirm the occurrence of such standing waves, and spacing of offshore bars in adjacent areas correlates well with the predicted position of the bars.

SHUMAN F. R. and C. J. LORENZEN, 1975. Quantitative degradation of chlorophyll by a marine herbivore. *Limnol. Oceanogr.*, 20 (4): 580-586.

In laboratory grazing experiments, primarily with *Calanus* sp. feeding on *Coscinodiscus angustii*, the decrease in chlorophyll concentration and the increase in pheophorbide concentration was determined. The average conversion of chlorophyll to pheophorbide was 66% on a weight basis and 100% on a molar basis. Some chlorophyll was found in fecal pellets. The specific absorption coefficient of pheophorbide in 90% acetone at 667 nm was 53.5 (g-cm)^{-1} , about the same as that of pheophytin under the same conditions. Previously published equations for the determination of pheophytin can be used for pheophorbide.

SIBUET MYRIAM, 1975. Astérides abyssales de l'Atlantique sud. (Résultats de la campagne Walda, juin - juillet - août 1971). *Bull. Mus. natn. Hist. Nat., Paris*, (3) 289 (Zool. 199): 281-298.

During Walda cruise of the N.-O. *Jean Charcot*, 21 Asterids species were collected in the abyssal plain of South East Atlantic. Two new species are described: *Dytaster cherbouneri* and *Benthopecten chardyi*. The analysis of infraspecific variations of *Freyella spinosa* makes doubtful the validity of *F. spinosa* var. *abyssicola*. Most species are widely distributed in the whole Atlantic Ocean; they were previously known merely from the Northern Atlantic. The Walvis ridge does not appear as a boundary for the dispersion of the Asterids.

SITARAMAIAH P., 1975. Temperature, salinity and plankton of Daman Ganga estuary. *J. Bombay nat. Hist. Soc.*, 72 (1): 132-142.

Temperature of air and water of Daman Ganga estuary showed two maxima in a year and the water was warmer than the Arabian Sea. A wide range of values of salinity were associated with a wide range of values of biomass of plankton. The values of biomass of plankton of this estuary, at comparable salinity and temperature, were three times less compared to the Mississippi Sound. The values of biomass of plankton in winter were 2.3 times higher compared to the values of biomass of plankton in summer. A plankton calendar was prepared for this estuary for the year 1968-69. An increase in the number of copepods was associated with an increase in the numbers of phytoplankton. Daman Ganga estuary is a special ecological habitat with warmer water and more numbers of microplankters compared to the adjoining Arabian Sea. Warmer waters and abundant microplankton of this estuary are the favourable factors for the survival and rapid growth of planktonic larvae of euryhaline marine fishes. Thus Daman Ganga estuary, with its special ecological conditions, forms one of the natural factors responsible for the good fish landings of this part of the west coast.

SMITH S. G., 1975. Research note measurement of airgun waveforms. *Geophys. J. R. astr. Soc.*, 42 (1): 273-280.

Airgun waveforms in the deep sea were measured from 160 in³ and 300 in³ guns with known firing pressure and depth, known geometry of source and receiver, and a recording system with known impulse response. The waveforms were compared with waveforms predicted from bubble oscillation theory and were found to be similar.

SOLOMON S. C., N. H. SLEEP and R. M. RICHARDSON, 1975. On the forces driving plate tectonics: inferences from absolute plate velocities and intraplate stress. *Geophys. J. R. astr. Soc.*, 42 (2): 769-801.

Absolute plate motions and intraplate stress both serve as tests of models for the forces acting on plate boundaries. Plate velocities relative to a presumed fixed underlying mantle are calculated from the hypothesis that no net torque is exerted on the lithosphere. Intraplate stress is calculated by solving the equilibrium equations for thin elastic shells in the membrane state of stress. The absolute velocity fields predicted from a wide assortment of physical and geological models are all very similar. While the global pattern of absolute velocity is probably close to those predicted by such models, the absolute motions do not therefore provide a strong test of the driving mechanism. Comparison of predicted intraplate stress with the long-wavelength features of the global stress field, however, as determined by *in situ* measurements, earthquake mechanisms, and stress-induced geological structures, does prove to be a powerful test of possible driving forces.

All absolute velocity models have several interesting properties. Lithosphere in the equatorial half of the Earth is moving significantly faster than lithosphere in the polar half. Some connection to the Earth's rotation is implied since this statement is demonstrably untrue for co-ordinate poles much different from the geographic pole. Subducted slabs are characterized by a slow horizontal translation perpendicular to strike that is independent of the plate convergence rate, confounding attempts to explain the dip angles of Benioff zones in terms of a uniform vertical sinking and a variable absolute velocity for the overthrust plate. Ridges must migrate at a wide range of velocities relative to their underlying source of new lithosphere; such rapid migration may be a necessary but is not a sufficient condition for ridge jumps.

Force models considered in velocity and stress calculations include driving forces at spreading centres and subduction zones and various parameterizations of drag at the base of the lithosphere. From the rms absolute velocities of individual plates, there is a weak indication that pull by the subducted lithosphere at trenches is an important driving force and that drag may be greater beneath continental than oceanic lithosphere. The predicted intraplate deviatoric stress cannot match the well-determined stress fields in North America and Europe unless the driving force exerted at ridges is at least comparable in magnitude to other forces in the system. The mid-plate stresses are very sensitive to the nature of drag at the base of the lithosphere and thus measured stresses may ultimately provide a sensitive test of absolute plate velocities.

SOYER JACQUES, 1974. Contribution à l'étude des Copépodes Harpacticoides de Méditerranée occidentale. II. Ameiridae Monard, Lang. Systématique, Écologie. *Vie Milieu*, (B) 24 (2): 379-408.

Our systematic investigations on the soft bottoms of the French Catalanian coast resulted in the collection of 26 species of Ameiridae (Copepoda Harpacticoida). Most of these had not been previously recorded on the coasts of France or in the Mediterranean. Four are new to science and are described: *Proameira echinipes* n.sp., *Pseudameira limicola* n.sp. and *Ps. perplexa* n.sp., *Limameira mediterranea* n.g.n.sp. The family Ameiridae has a low numerical importance despite the diversity of species. In general terms, their distribution closely follows that of the mean and coarse fractions of the sediments. A detailed analysis of the distribution of the main species reveals certain specializations.

SPILLANE MICHAEL and P. P. NIILER, 1975. On the theory of strong, midlatitude wind-driven ocean circulation, I. The North Pacific countercurrent as a quasi-geostrophic jet. *Geophys. Fluid Dynam.*, 7 (1): 43-66.

A characteristic feature of the circulation in the tropical ocean is that a few degrees north of the equator there exists a strong easterly surface flow, the Equatorial Countercurrent. Sverdrup in 1947 correctly showed that the momentum balance in the countercurrent is quasi-geostrophic, but the corresponding description of the vorticity balance over its entire longitudinal extent is not complete. The present analysis is based on a model of a two-layer quasi-geostrophic circulation. The observation that latitudinal changes in upper-layer depth are less than longitudinal changes is exploited to reduce the nonlinear vorticity equation to an ordinary differential equation by a class of similarity transformations. Some of the features of the circulation in the western tropical Pacific that can be modeled, include the observation that north and south of the countercurrent there exist westward currents, somewhat broader and less intense than the countercurrent, and that there is a monotonic decrease of zonal transport to the east. In addition, the structure of the countercurrent is not necessarily determined by the local structure of the zonal wind field. These solutions asymptotically approach Sverdrup circulation to the north and south of the zero of the wind-stress curl.

STEELE D. H. and V. J. STEELE, 1975. The biology of *Gammarus* (Crustacea, Amphipoda) in the northwestern Atlantic. IX. *Gammarus wilkitzkii* Birula, *Gammarus stoerensis* Reid, and *Gammarus mucronatus* Say. *Can. J. Zool.*, 53 (8): 1105-1109.

Gammarus wilkitzkii is a circumpolar, arctic species found from the Arctic Ocean south to Newfoundland. Females produce a single large brood of large eggs in the autumn or early winter which hatches and is released from April to July. The species matures at a relatively large size.

Gammarus stoerensis is an Atlantic amphiboreal species found from eastern Nova Scotia south to Rhode Island. It is a small species and females produce a series of small broods of small eggs between the spring and autumn, but are in the resting stage between then and later winter.

Gammarus mucronatus is found from southwestern Newfoundland south to the Gulf of Mexico. It is a small species and produces a low number of small eggs in each of several summer broods.

STEELE D. H. and V. J. STEELE, 1975. The biology of *Gammarus* (Crustacea, Amphipoda) in the northwestern Atlantic. X. *Gammarus finmarchicus* Dahl. *Can. J. Zool.*, 53 (8): 1110-1115.

Gammarus finmarchicus is an amphi-Atlantic species. In the western Atlantic it is found from the island of St. Pierre south to Long Island Sound. At St. Andrews, New Brunswick, 50% maturity occurs at 10.5 mm in the females. Reproduction is in progress throughout the year, but small females evidently are in a resting condition during September-October before breeding. The release of young by the population is greater in the spring, summer, and early autumn than it is in late autumn and winter. The young released in the spring and summer do not reproduce until the next year so that the life cycle is annual.

STEELE D. H. and V. J. STEELE, 1975. The biology of *Gammarus* (Crustacea, Amphipoda) in the northwestern Atlantic. XI. Comparison and discussion. *Can. J. Zool.*, 53 (8): 1116-1126.

Available data on some aspects of the biology of 10 species of *Gammarus* are summarized and compared. It is concluded that the main adaptation allowing these species to occupy their extensive geographic range from the North Pole to the Gulf of Mexico is variation in body size. The large size of northern species (*G. wilkitzkii* and *G. setosus*) results in the production of a single, large, well-timed brood, which is released within the short period of optimum conditions. The medium-sized species (*G. oceanicus*, *G. duebeni*, *G. finmarchicus*, and *G. obtusatus*) produce several medium-sized broods spread through the longer optimum season. The small species (*G. lawrencianus*, *G. tigrinus*, *G. stoerensis*, and *G. mucronatus*) can produce a large number of small broods per female and also mature second generations in the much longer and warmer optimum season characteristic of the southern environment.

STEGEN G. R., KIRK BRYAN, J. L. HELD, and FEODOR OSTAPOFF, 1975. Dropped horizontal coherence based on temperature profiles in the upper thermocline. *J. geophys. Res.*, 80 (27): 3841-3847.

A series of 66 temperature profiles taken in the open ocean 350 km north of Puerto Rico are analyzed to determine the displacement spectrum and the dropped horizontal coherence. The results are not inconsistent with the Garrett and Munk model. One interesting exception is a tendency for the horizontal coherence not to fall off monotonically with decreasing vertical scales.

STEPANOV V. N. and L. S. SVETLICHNY, 1975. On the estimation of the passive vertical displacement rate of planktonic organisms. (In Russian; English abstract.) *Okeanologiya*, 15 (2): 321-324.

After a number of experiments on the *Calanus helgolandicus* models, factual ranges of the use of Stokes' formula for the estimation of vertical migration rates of planktonic organisms have been determined. A more universal method is proposed for estimating vertical displacement rates of zooplankton. The method is based on the dynamic equilibrium equation of the vertically displacing body with consideration for experimental friction coefficients.

STEWART D. C. and C. P. THORNTON, 1975. Andesite in oceanic regions. *Geology*, 3 (10): 565-568.

Among the chemically intermediate rocks of the central ocean basins, three genetic series—tholeiitic, low-K alkalic, and high-K alkalic—are recognizable on the basis of relations between the differentiation index (DI) and total alkalis and between DI and the alkali index [AI, here defined as $100 \times K_2O / (K_2O + Na_2O)$]. The present nomenclature for these rocks, using terms based on locality names (hawaiite, tristanite, icelandite, and so forth), is inconsistent. Names based on chemical differences do not cover the range in composition, and names based on mineralogical differences do not reflect existing differences in chemistry.

Alternatives to this "locality" nomenclature are considered: First, andesite is redefined, regardless of its geographic occurrence, as a volcanic rock in which more than 2/3 of the feldspar is plagioclase, the groundmass plagioclase is oligoclase or andesine, normative quartz is less than 15 percent, and the color index is less than 40. By prefixing this generalized andesite with appropriate terms indicating the genetic series, geographic location (for example, "oceanic"), and distinctive mineralogy, a consistent and informative nomenclature is possible. A second alternative is to define in a more consistent fashion the present locality names of the intermediate rocks by grouping them into two sets, one based on modal composition (mugearite, hawaiite), the other on chemistry (trachyandesite, trachybasalt).

STEWART M. K. and IRVING FRIEDMAN, 1975. Deuterium fractionation between aqueous salt solutions and water vapor. *J. geophys. Res.*, 80 (27): 3812-3818.

The equilibrium fractionation factors for the partitioning of deuterium between pure water and water vapor at several temperatures ($19^\circ - 27^\circ\text{C}$) and between aqueous salt solutions and water vapor as a function of salt concentration at 20°C are reported. The fractionation factors for the salt solutions show a linear variation with salt concentration and depend on the nature of both the cations and the anions in solution. One molal solutions of the salts show the following differences in ppt from the pure water factors: NaCl, -2.3; KCl, -2.5; CaCl₂, -4.9; MgCl₂, -9.2; AlCl₃, -17.2; NaBr, -3.3; NaI, -4.6; Na₂CO₃, -5.2; Na₂SO₄, +0.7; K₂SO₄, +0.7; and seawater (0.31 m), -1.6. Geochemical applications of the results are discussed.

SUDA TAKIO, 1975. On the cause of unusual high tide. (In Japanese; English abstract.) *Bull. Maizuru mar. Obs.*, 13: 15 pp.

Since unusual high tide usually occurs in the months when the mean tide level is high, the mechanism of rising or falling monthly mean tide levels was researched.

A statistical analysis of monthly mean tide levels at Aburatsubo ($31^\circ 35' \text{N}$, $131^\circ 24' \text{E}$) is shown in relation to surface air pressure patterns over the western Pacific for August and September 1950-71. A major contributing factor to monthly mean tide levels is found to be the surface pressure pattern.

Periodic changes in the tide level, such as 19.0-year change and 9.0-year change (both astronomical tides) and 7.0-year change (combined tide; accompanied with 7.0/2-year harmonics, this has large amplitudes and is considered to be a combination of astronomical, meteorological and oceanic periodicities), are subtracted from the year-to-year values to obtain the residual, $\Delta H - a$ for August and September. The relationship between $\Delta H - a$ and surface pressure patterns of large scale, having dimensions of the order of an ocean, and of medium scale, having the order of several hundred km², is investigated. Major results show monthly mean tide level is high when: (a) The difference between the pressure in the central part of the North Pacific High and that in the vicinity of Japan is large for one or two preceding months (static pressure effect). (b) Monthly mean pressure gradient in a medium scale region is large with the coast at its lower-pressure end (static pressure effect). (c) A large pressure gradient exists locally in a direction such that the resultant winds are parallel to the coastline located to the left (facing the direction from which the winds come).

SUN SHINE-SOON, MITSUNOBU TATSUMOTO and JEAN-GUY SCHILLING, 1975. Mantle plume mixing along the Reykjanes Ridge axis: lead isotopic evidence. *Science*, 190 (4210): 143-147.

Gradients of lead isotopic ratios from basalts erupted along the Reykjanes Ridge and Median Neovolcanic Zone of Iceland confirm mantle plume mixing with the depleted asthenosphere along the ridge axis.

TABATA TADASHI, 1975. Sea-ice reconnaissance by radar. *J. Glaciol.*, 15 (73): 215-224.

To observe the distribution of pack ice off the coast of the Okhotsk Sea coast of Hokkaido, a radar network consisting of three radar stations was constructed during 1967-69. It covers an area about 70 km wide and 250 km long. The stations are remote-controlled by radio from the Sea Ice Research Laboratory and the information obtained is transmitted back to the laboratory and observed there. Radar has the great advantage of being able to make continuous observations of ice. Usually several special features can be seen on the radar screen, and they are used as markers for the observation of movement. It is ascertained that the average pattern of drift in this area is from north to south-east along the coast line and the ice field undergoes internal deformation during its drift. To get some information on the surface topography of ice from A-scope radar, the intensity of echo signals is classified into 16 steps by computer. To obtain the movement of an ice field from the numerical radar information, a modified two-dimensional cross-correlation method was tested.

TAKAGI MITSUZO, HANAKO MURAYAMA and SUGA SOMA, 1975. PCB contents in several species of flatfish collected in the eastern Bering Sea. (In Japanese; English abstract.) *Bull. Jap. Soc. scient. Fish.*, 41 (6): 685-690.

Materials used for the present study of polychlorinated biphenyls (PCB) concentrations in the muscle, liver and egg of four species of flatfish were collected from 14 locations in the eastern Bering Sea. Analysis proved that PCB concentrations in muscle ranged between 0.02-0.13 ppm with distinct differences within the same species depending on the source location. PCB contents in liver samples ranged from 0.06-0.27 ppm, i.e., always higher than the muscle values, and egg PCB contents were 0.01-0.03 ppm, i.e., lower than muscle levels.

TANIOKA KATSUMI, 1975. On the relationships between the oceanographic conditions and the sea level in the Japan Sea. (In Japanese; English abstract.) *Bull. Maizuru mar. Obs.*, 13: 8 pp.

Relationships between the oceanographic conditions in the Japan Sea and the sea levels at the tidal stations along the coasts of Japan and Korea were studied, using oceanographic data obtained by several vessels, chiefly the Seifu Maru of the Maizuru Marine Observatory, and tidal data obtained by tidal stations at Tonoura, Sakai, Saigo, Maizuru, Toyama, Niigata and Ulsan during the period from 1967 to 1972.

The high sea level along the coast of Japan is caused by the high water temperature at the middle part of the Tsushima Strait, and vice versa. There may be close relationships between sea level along the coast of Japan and the flowing course of the Tsushima Current; the high sea level at Maizuru was observed in 1969 when the Tsushima Current flowed near the coast of Japan, and yet the sea level there was also raised in 1972 when the Tsushima Current flowed far offshore.

The dynamic height of the sea surface in the Japan Sea referred to the 500-db surface in 1972 was higher by 10 dyn.cm than that in 1970, and the sea level at Maizuru in 1972 was higher by 14 cm than that in 1970. The amplitudes of fluctuations of both dynamic height of sea surface and the sea level were of nearly the same magnitude.

TAYLOR P. T., D. J. STANLEY, TOM-SIMKIN and WALTER JAHN, 1975. Gilliss Seamount: detailed bathymetry and modification by bottom currents. *Mar. Geol.*, 19 (3): 139-157.

A bathymetric survey of the Gilliss Seamount, in the northwest Atlantic Basin, using a multi-beam sonar array system reveals an extremely complex morphologic character of this feature. A new chart provides the most detailed topographic presentation of an Atlantic seamount published to date and highlights the similarity of the Gilliss Seamount with terrestrial strata-volcanoes. Bottom photographs and samples reveal pillow-lava formation. Seismic profiles show that the volcanic basement is irregularly covered by acoustically transparent deposits that are as much as 668 m thick. Volcanic debris and sediments locally are displaced down the flanks of the seamount. Bottom photographs and cores indicate that the transparent layer has accumulated slowly by deposition from suspensate-rich (mostly clay and planktonic foraminifera) water masses that flow around the mid to lower sectors of this submarine volcano. Bottom-current activity also modifies the abyssal plain turbidite-hemipelagic sequence surrounding the seamount.

TETT PAUL, J. C. COTTRELL, D. O. TREW and B. J. B. WOOD, 1975. Phosphorus quota and the chlorophyll: carbon ratio in marine phytoplankton. *Limnol. Oceanogr.*, 20 (4): 587-603.

From work on nutrient limited algal growth an equation was derived relating algal chlorophyll: carbon ratio (ccr) to cell nutrient quota (Q).

$$ccr = ccr_{max} [(1 - k'_Q/Q) + (r/\mu'_{max})]$$

where r/μ'_{max} is a constant representing the ratio of specific respiration rate to maximum specific growth rate, k'_Q is an (apparent) subsistence quota, and ccr_{max} is a third constant—the value of the Chl: C ratio when $Q/k'_Q = \mu'_{max}/r$. This hypothesis was investigated using data from the spring phytoplankton increase in Loch Creran in 1973. The quota was measured as the phytoplankton P: C atomic ratio, and a regression method was used to estimate detrital phosphorus and carbon in order to correct measurements made of total particulate material. Although phosphorus did not appear to be the single limiting nutrient, and hence the estimates of k'_Q were of an apparent rather than true subsistence quota, the equation was shown to be a reasonable description of the relation between the chlorophyll, phosphorus, and carbon contents of the phytoplankton over two periods of 3-4 weeks each. During the period of phytoplankton increase k'_Q and ccr_{max} were estimated as 0.014 atom P/atom C and 0.083 g Chl/g C; during the period of decline the respective values of these constants were 0.0062 and 0.040.

TIMMERMAN H., 1975. On the importance of atmospheric pressure gradients for the generation of external surges in the North Sea. *Dt. hydrogr. Z.*, 28 (2): 62-71.

In this paper it is shown that external surges in the North Sea can be generated not only by westerly winds over the continental shelf near Scotland, but also by air pressure gradients near the transition zone of deep to shallow water. The importance of the latter effect, which has been neglected in the literature so far, is illustrated by some cases with an external surge and also by the Hamburg surge of 16 February 1962, which appeared to be accompanied by a rather important external component.

TOOMA S. G., R. A. MENNELLA, J. P. HOLLINGER and R. D. KETCHUM Jr., 1975. Comparison of sea-ice type identification between airborne dual-frequency passive microwave radiometry and standard laser/infrared techniques. *J. Glaciol.*, 15 (73): 225-239.

During December 1973, the Naval Oceanographic Office (NAVOCEANO) and the Naval Research Laboratory (NRL) conducted a joint remote-sensing experiment over the sea-ice fields off Scoresby Sound on the east coast of Greenland using NAVOCEANO's RP₃-A Birdseye aircraft, laser profiler, and infrared scanner, and NRL's 19.34 and 31.0 GHz nadir-looking radiometers. The objectives of this mission were: (1) to develop skills for interpreting sea-ice passive microwave data, (2) to expand, if possible, the two-category capability (multi-year ice and first-year ice) of passive microwave sensors over sea ice, (3) to compare two frequencies, 19 and 31 GHz, to determine which may be more useful in a scanning radiometer now under development at NRL, and (4) to determine the value of multi-frequency as compared to single-frequency study of sea ice.

Since, because of darkness and remoteness, no photography or *in situ* ground truth were possible for this mission, it was necessary to rely on the interpretations of the laser and infrared (IR) data to evaluate the performance of the microwave radiometers. Fortunately, excellent laser and IR data were collected, and a confident description of the ice overflow was possible.

Five ice conditions: (1) open water/new ice, (2) smooth first-year ice, (3) ridged first-year ice, (4) multi-year ice, and (5) a higher brightness temperature form of multi-year ice interpreted as second-year ice were identifiable, regardless of weather conditions, by comparing the average of the two microwave brightness temperatures at the two frequencies with their difference.

TRÉHU A. M., 1975. Depth versus (age)^{1/2}: A perspective on mid-ocean rises. *Earth planet. Sci. Letts*, 27 (2): 287-304.

The straight-line relationship between depth and the square root of age predicted by recent variations of the thermal contraction model for ocean rise elevation is confirmed to an age of 80 m y.

We then examine this relationship in the immediate vicinity of the rise crest in an attempt to determine the sensitivity of the slopes thus obtained. Depth versus $t^{1/2}$ profiles from a variety of rise types ranging from the topographically smooth, fast-spreading Pacific-Antarctic rise to the rough, slow-spreading Mid-Atlantic rise are discussed, ages having been assigned using a finite rotation pole. Because of the variety of superimposed anomalous features concentrated within a limited and well-surveyed region, the Galapagos Spreading Center has provided a suitable arena for determining the precision with which the method can decompose such an agglomeration into distinctly recognizable components. Although topographic "noise" precludes precise quantification of the slopes, it is concluded that, by removing the first-order effect of thermal contraction, the method can be quite revealing when topography is examined in relation to other data. Slopes for several profiles across the Pacific-Antarctic and Pacific-Nazca rises reveal the pattern expected in the case of asymmetric spreading, a conclusion which has independently been derived from the magnetic anomalies. In the Galapagos region "jumps" of the spreading center, a basic compositional difference, and uplift from below are exposed by their predictable effect on the slopes obtained from the depth versus $t^{1/2}$ plots.

UEDA TAISHI, YUZURU SUZUKI and RYOICHI NAKAMURA, 1975. Accumulation of Sr in marine organisms, II. The level of ⁹⁰Sr in marine organisms from the coastal Sea of Japan. *Bull. Jap. Soc. scient. Fish.*, 41 (6): 691-698.

To determine the level of ⁹⁰Sr intake by marine organisms from fallout, fish (whole body and bone), molluscan shell and brown seaweed from the coastal waters of Japan were investigated during the period from 1963 to 1971. From these observations, the ⁹⁰Sr concentration factor and observed ratio were calculated. The ⁹⁰Sr level in marine organisms was found to have gradually decreased since 1963 in parallel with the decrease in sea water ⁹⁰Sr content: from 0.5 SU in 1963 to 0.1 in 1971 for fish bone. The concentration factors for ⁹⁰Sr ranged from 12 to 109 in fish bone, from 40 to 205 in molluscan shell and from 3 to 10 in brown seaweed. The observed ratios for ⁹⁰Sr were 0.40, 0.32, 0.21 and 3.54 in bone and whole body of fish, molluscan shell and brown seaweed, respectively. These figures were similar to those for stable Sr. The ⁹⁰Sr specific activity in marine organisms was also comparable to that in sea water, suggesting that, for marine organisms, fallout ⁹⁰Sr becomes physicochemically indistinguishable from stable Sr within a relatively short time after entering sea water.

VALLANCE T. G., 1975. Origins of Australian geology: Presidential address. *Proc. Linn. Soc. N.S.W.*, 100 (1) (441): 13-43.

One hundred years ago, when the Linnean Society of New South Wales began, geology in this country was a 'colonial' science—its base of authority was still in Europe. For almost a century, geology in Australia had been dominated by concepts which originated in Europe and were transported, more or less uncritically, to a land being explored. European precedent is seen as having exerted, in many cases, a counter-productive influence on geological understanding here in the years before 1875.

VAN IEPEREN M. P., 1975. The bottom friction of the sea-bed off Melkbosstrand, South Africa: A comparison of a quadratic with a linear friction model. *Dt. hydrogr. Z.*, 28 (2): 72-88.

One of the most important problems in coastal wave prediction is the estimation of the transformation of waves which takes place as they travel from deep to shallow water. The transformation depends on the combined effect of the non-dissipative forces such as refraction, shoaling and diffraction, and the dissipative-generative forces such as wave breaking, wind generation and bottom friction. The dissipative-generative forces are not well understood.

To investigate the importance of bottom friction in wave decay near Melkbosstrand, wave recordings have been made quasi-synoptically at 4 stations, with a ship-borne wave recorder. The stations were positioned on a straight line, in depths varying from 45 to 11 m. One-dimensional frequency spectra were computed from the data and used to calculate the friction factors for a quadratic and a linear friction model. Only wave fields where refraction was negligible have been analysed.

Estimates of the friction factor for a quadratic model were obtained by using the expression as given by Bretschneider and Reid (1954) and also by using the energy balance equation, with a source function for the spectral dissipation of energy, as given by Hasselmann and Collins (1968). In the latter case, the estimates were calculated from the flux changes of the integrated spectra and from the flux changes of the spectral components of the spectra, both for a quadratic and for a linear friction model. Differences in the decay rates of the spectral components have also been investigated. For a quadratic model, the mean values of the estimates ranged from 0.06 to 0.10. This is a factor 4 to 6 larger than normally accepted for comparative areas. The agreement between the results of the two methods used is satisfactory.

For a linear model, the mean value of the estimates as obtained from the integrated spectra is 0.039 m/s, with a coefficient of variation of 33%. The mean value of the estimates as obtained from the spectral components of the spectra is 0.038 m/s, with a coefficient of variation of 76%. The variability of the estimates from the linear model is less than observed for a quadratic model.

VERGNAUD GRAZZINI C., 1975 ^{18}O changes in foraminifera carbonates during the last 10^5 years in the Mediterranean Sea. *Science*, 190 (4211): 272-274.

The Mediterranean response to major climatic events during the Upper Pleistocene could be seen as an integration of the principal phenomena particular to oceans and of regional phenomena peculiar to the Mediterranean Sea. The magnitude of oxygen isotope changes in foraminifera tests suggests that the temperature variations between stadial and interstadial periods could not exceed 11°C and that the correction factor for isotopic changes of waters should be about twice the value used for the oceans, or 2.7 per mil.

VERMEER KEES and REBECCA VERMEER, 1975. Oil threat to birds on the Canadian west coast. *Can.Fld. Nat.*, 89 (3): 278-298.

The potential effects of oil spills on aquatic birds and their feeding habitat on the Canadian west coast are assessed and the related literature on oil pollution is reviewed. Present shipping and transport of oil and increased tanker traffic along the entire British Columbia coast in 1977 constitute a threat to the destruction of birds from oil spillage.

Concentrations of seabirds will be most vulnerable to spills. Three major colonies along the coast of British Columbia are the Langara Region, the southeast coast of the Queen Charlotte Islands, and the Scott Islands. Alcids and storm petrels are the most numerous seabirds along the British Columbia coast. Alcids are among the birds most vulnerable to oil pollution whereas storm petrels are less threatened by spills than alcids because they spend more time in the air and only dive occasionally. Waterfowl, especially diving ducks, will be vulnerable to spills during the winter as they concentrate in large numbers in estuaries and inlets along the British Columbia coast. The large wintering populations of ducks, geese, and grebes along the Fraser Delta foreshore and Boundary Bay will be endangered because of their nearness to tanker and shipping traffic. Approximately one million loons, shearwaters, phalaropes, ducks, gulls, and geese migrate north in the spring along west Vancouver Island. These migrants, because of their concentration in large numbers, may be very temporarily but critically vulnerable to oil pollution.

The birds most likely to be directly affected by spills are breeding populations of alcids and wintering diving ducks, whereas ducks, geese, and shorebirds, which feed in the intertidal zone, may be hardest hit indirectly through destruction of their feeding habitat. Of the ducks threatened by destruction of their feeding habitat, seaducks are most vulnerable of all ducks as they rely on most on the marine habitat for feeding purposes.

VEROSUB K. L., 1975. Paleomagnetic excursions as magnetostratigraphic horizons: A cautionary note. *Science*, 190 (4209): 48-50.

Sediments from certain environments with high rates of deposition are not remagnetized after they have been deformed. The paleomagnetic signature from a zone of deformation can be misinterpreted as evidence for globally coherent fluctuations in the earth's magnetic field.

VINOGRADOV M. E., V. F. KRAPIVIN, B. S. FLEISHMAN and E. A. SHUSHKINA, 1975. The use of a mathematical model for the analysis of the behaviour of a pelagic ecosystem in the ocean. (In Russian; English abstract.) *Okeanologia*, 15 (2): 313-320.

Modification of the parameters of the formerly developed model describing the functioning of a pelagic ecosystem in the tropical ocean shows that essential changes of the initial conditions of the ecosystem affect only slightly its structure, especially so when system exists for a long time. The spatial and the trophic structure of the system is shown to differ considerably from the actually observed one under a sharp decrease of the vertical rate of water motion, $< 10^{-5}$ cm/sec, at a stable low, < 0.5 , or high $> 3 \cdot 5$ diurnal P/B coefficient of phytoplankton. Changes in the losses for metabolism and food assimilation at the lower trophic levels influence the behaviour of the system more strongly than these changes at the higher levels.

VOLKBERT KELL und M. A. H. SAAD, 1975. Untersuchungen über das Phytoplankton und einige Umweltparameter des Shatt al-Arab (Irak). *Int. Rev. ges. Hydrobiol.*, 60 (3): 409-421.

Samples of phytoplankton were taken from the Euphrat and Tigris estuaries, Shatt al-Arab, in April 1974 and investigated by means of the inverted microscope. Among 226 species identified in the samples 96 were of marine origin. The share of diatoms in the total numbers of cells from all stations amounted to 68%. The abundance of planktonic green algae amounted to 19%, of the blue greens to 13%. The number of marine species continuously increased in the longitudinal axis of the 139 km section considered. The data of the phytoplankton were compared to the gradation of environmental variables such as temperature, transparency, dissolved oxygen, and chloride. Regular longitudinal or vertical differences of these parameters were not observed.

VONDER HAAR S. P. and D. S. GORSLINE, 1975. Flooding frequency of hypersaline coastal environments determined by orbital imagery: Geologic implications. *Science*, 190 (4210): 147-148.

Available satellite imagery in the infrared and near-infrared wavelengths provides a simple, rapid, and low-cost method for monitoring the extent and duration of the flooding of coastal ecosystems. Hypersaline environments in Baja California, Mexico, are flooded as a result of complex interactions between the higher of the two spring tides each month and local winds. Such flooding necessitates a reappraisal of ideas on rhythmic lamination in algal mats, stromatolites, and evaporite sediments preserved in the geologic record.

VUKOVICH F. M. and B. W. CRISSMAN, 1975. Case study of exchange processes on the western boundary of the Gulf Stream using NOAA-2-satellite data and ship data. *Remote Sens. Environ.*, 4 (2): 165-176.

Eddies on the western boundary of the Gulf Stream off the southeast coast of the United States were studied using NOAA-2 IR data and data collected by the R/V *Dallas Herring*. The eddies in question had short life cycles (not much more than 72 hours) and were of small vertical extent (at most 60 m deep). These eddies appear to be the result of the steering of currents in shelf water toward the Gulf Stream boundary by the shoals found off the various capes from Cape Hatteras southward. This led to the penetration of a tongue of shelf water into the Gulf Stream and an eventual isolation of a lens of Gulf Stream water on the shelf.

WATSON K. M. and B. J. WEST, 1975. A transport-equation description of nonlinear ocean surface wave interactions. *J. Fluid Mech.*, 70 (4): 815-826.

An energy transport equation describes the evolution of the power spectrum of surface gravity waves. A slowly varying, prescribed ocean current and wind source are assumed to account for spatial inhomogeneities in the surface wave spectrum. These inhomogeneities lead to a new nonlinear wave-wave interaction mechanism.

WEBB K. L. and W. J. WIEBE, 1975. Nitrification on a coral reef. *Can. J. Microbiol.*, 21 (9): 1427-1431.

We report that the algal pavement just behind the reef crest at Enewetak Atoll produces nitrate at measurable rates. *In situ* and *in vitro* incubations with N-Serve® indicate that the autotrophic pathway involving two separate organisms is effective in this oxidation of ammonia to nitrate. Significant nitrification is indicated throughout the reef environment: *Nitrobacter agilis* has specifically been identified as at least one of the organisms responsible for the terminal oxidation of nitrite to nitrate.

WEICHART GÜNTER, 1975. Untersuchungen über die Fe-Konzentration im Wasser der Deutschen Bucht im Zusammenhang mit dem Einbringen von Abwässern aus der Titandioxid-Produktion. *Dt. hydrogr. Z.*, 28 (2): 49-61.

Since May, 1969, 20-30 km northwest of Helgoland, tankers have dumped about 1800 tons/day of waste from titanium dioxide production. Together with large amounts of H₂SO₄, about 93 t Fe, 8 t Ti, 500 kg Mn, 25 kg V, 70 kg Cr, etc., per day are dumped. Through reaction with the seawater, Fe, Ti, Mn, Cr, and Al precipitate as hydroxides which can scavenge even further (such as the Vanadium). Therefore it is possible to understand the behaviour of Fe, Ti, Mn, Cr, and Al, and perhaps Vanadium by measuring one of these metals. We have chosen Fe as "tracer", because it is dumped in large quantities and is easy to analyse.

The highest total-Fe concentrations occur in the vicinity of the coasts as well as in the dumping area. The high total-Fe concentration off the coasts is due mostly to the inflow of Fe-rich river water from the Elbe and the Weser, but it can also be traced back to the shallow water depths and the nature of the sediments. In the vertical series, there is a heavy increase in the total-Fe concentration downward caused by the disturbance of fine sediment containing Fe, or Fe hydroxides. Under calm seas particulate Fe sinks to the bottom within a few hours. As the largest part of the Fe is particulate, only negligible Fe remains in the water. The smallest total-Fe concentration found was about 5 µg Fe/l. Under conditions of turbulence, particulate Fe is whirled up from the bottom and is distributed in the whole water column. The largest total-Fe concentration outside the visible wake of the tankers, was about 500 µg Fe/l. In addition to this variability governed by wind conditions, there is a short term variability within the space of minutes due to uneven distribution during dumping. The highest Fe concentrations were found in the fresh screw water of the dump tanker. One hour after dumping, the total-Fe concentration was about 7,000 µg Fe/l; after 2 hours, about 2,500 µg Fe/l.

In the dumping area a cloud of Fe hydroxide was found at all times. Fe contained in this cloud corresponds approximately to that dumped during a period of several weeks. A steady increase of the amount of Fe in the German Bight could not be established. Evidently, the Fe is transported by the residual currents out of the German Bight into the open North Sea. The area of final deposition of the Fe has not yet been found. It seems possible that the Fe hydroxide is transported as far as the Norwegian Sea, or the Atlantic.

WEISS E. B., 1975. International responses to weather modification. *Int. Orgn.*, 29 (3): 805-826.

In the past few decades we have been improving our understanding of the weather system and exploring ways to modify it. Over sixty countries have experimented with modifying the weather. The new technology of weather and climate modification will raise important political problems which will demand new responses from the international community. Whether states will be able to establish the cooperative measures necessary to develop and manage new technology depends upon whether there are sufficient incentives to do so. This article analyzes the historical patterns of international cooperation in meteorology, and then plots against several time horizons projected developments and capabilities in weather modification technology and the potential problems emerging from using the technology. It derives a tentative picture of the responsibilities demanded, compares the likely responses with those needed, and assesses whether they will be adequate for the problems projected.

WHITEHEAD J. A. Jr., 1975. Mean flow generated by circulation on a β -plane: An analogy with the moving flame experiment. *Tellus*, 27 (4): 358-364.

A number of laboratory experiments are described in which water with a curved upper surface in a rotating basin exhibited prograde flows when stirred by stirrers which put no azimuthal torque upon the fluid. It is suggested that the flows were generated by Reynolds stresses of the circulating fluid, and that this is a general consequence of circulations on a β -plane. This is reinforced by an analogy between the equations of the moving flame experiment and the equations of flow on a β -plane. Implications upon atmospheric and oceanic flows are mentioned.

WHITFIELD M., 1975. An improved specific interaction model for seawater at 25°C and 1 atmosphere total pressure. *Mar. Chem.*, 3 (3): 197-213.

Equations recently developed by Pitzer are applied to a seawater model on the assumption that only interactions between ions of opposite charge sign are significant. This model is shown to give good agreement with available experimental data for the osmotic coefficient and for the mean-ion activity coefficients of the major electrolyte components. The results are compared with the predictions of the ion-association model and with a number of models using the concept of specific ionic interaction. The relative merits of the various models are discussed. Pitzer's original equations are modified to enable the calculation of conventional single-ion activity coefficients. These values are compared with those obtained on the basis of alternative conventions and an encouraging measure of agreement is observed. It is concluded that the new model introduces a fluency into the specific interaction approach that should greatly facilitate the incorporation of trace components into future models.

WHITMARSH R. B., 1975. Axial intrusion zone beneath the Median Valley of the Mid-Atlantic Ridge at 37°N detected by explosion seismology. *Geophys. Jl R. astr. Soc.*, 42 (1): 189-215.

Four seismic refraction lines, three of which had shots every 250 m, were shot across, along and parallel to the median valley of the Mid-Atlantic Ridge at 37°N. A method has been developed for calculating the effect on the travel times of the rough sea-floor relief beneath the profiles and has been used to correct all the travel times for this effect. Most arrivals were from a main refractor of apparent velocity 5.4 to 6.3 km s⁻¹; only beyond 35 km were faster arrivals observed from an 8.09 ± .36 km s⁻¹ refractor. The main refractor corresponds in depth, at least approximately, to the top of Layer 3 of the ocean basins but its velocity is significantly less than normal for Layer 3, perhaps due to dip. A study of time residuals along two profiles across the median valley indicates the presence of a 2 to 3 km wide low velocity zone (about 3.2 km s⁻¹) beneath the median valley floor. This zone extends over the upper 2.5 km of the crust and is believed to represent a zone of intrusion through which magma passes on its way to the sea floor.

WILKENING M. H. and W. E. CLEMENTS, 1975. Radon 222 from the ocean surface. *J. geophys. Res.*, 80 (27): 3828-3830.

The flux of ²²²Rn from the ocean surface has been measured by the accumulation method off the windward coast of the island of Hawaii. A figure of 74 ± 8 atoms m⁻² s⁻¹ was obtained, compared with a range of values from 11 to 116 atoms m⁻² s⁻¹ calculated from near-surface ²²²Rn concentration profiles in seawater obtained by other investigators. If these results are representative, the total oceanic contribution to ²²²Rn in the global atmosphere is only about 2% of all ²²²Rn exhaled from continents. Fluxes obtained by the accumulation method in shallow bay waters nearshore were intermediate to the very low value measured in the open ocean and the values obtained onshore.

WILLEY J. D., 1975. Reactions which remove dissolved alumina from seawater. *Mar. Chem.*, 3 (3): 227-240.

Dissolved alumina can coprecipitate with dissolved silica from seawater enriched with both compounds. This coprecipitation is almost complete within 1 h and maintains the concentration of dissolved alumina near naturally occurring oceanic concentrations, well below the alumina concentration of 0.50 ppm Al found to be stable in filtered Sargasso seawater at 2°C. Only 0.5 ppm Si is necessary to initiate this coprecipitation, which indicates that the concentrations of dissolved alumina that occur in seawater and in interstitial water are a function of the concentration of dissolved silica as well as of the alumina solubility.

Dissolved alumina is also quickly removed by solid amorphous silica from solutions of seawater enriched in dissolved alumina and also by several marine sediments in contact with the solution. This process may be an important factor in authigenic mineral formation in marine sediments.

WILLEY J. D., 1975. Silica-alumina interactions in seawater. *Mar. Chem.*, 3 (3): 241-251.

Amorphous silica can polymerize in distilled water, in 0.6 N NaCl solution and in seawater to form a colloidal suspension that contains approximately 200 ppm Si. Solid amorphous alumina can prevent this polymerization in seawater and in 0.6 N NaCl, and can inhibit but not prevent it in distilled water. This prevention of polymerization may be an important factor in authigenic mineral formation.

The presence of solid amorphous alumina with solid silica in the same solutions causes the final concentrations of dissolved silica to be lower than those attained by solid silica in the absence of solid alumina. The effects are similar whether the final levels are approached from above or below the saturation concentration for amorphous silica. This indicates that the observed concentration of dissolved silica will be a function of available alumina as well as of the silica solubility. The presence of solid amorphous alumina with quartz in seawater, 0.6 N NaCl solution and distilled water causes dissolved silica levels to remain below 0.7 ppm Si for at least 38 days. The same systems in the absence of alumina approach the solubility levels of quartz within that time period.

WILLIAMS ELIZABETH, CHARLES SWITHINBANK and G. de Q. ROBIN, 1975. A submarine sonar study of Arctic pack ice. *J. Glaciol.*, 15 (73): 349-362.

A continuous profile of the Arctic Ocean ice canopy from Spitsbergen to the North Pole was made with 48 kHz echo sounders mounted on a nuclear submarine. A semi-automatic digitizer was used to measure coordinates from the records at a frequency of about 1,000 points per linear kilometre of track. Methods derived for the reconstruction of subglacial relief from 35 MHz radio-echo sounding records were applied to eliminate part of the distortion due to the 20° beam width of the sounders. A corrected profile was used to obtain ice drafts at 2 m intervals. Data were analysed in 10 km sections and figures were summarized for each degree of latitude. The results include: mean ice draft, percentage of ice less than 0.3 m draft, and percentage of level ice. Histograms show the level ice drafts which occur most frequently, and these may indicate the ratio of first-year to older ice. The number of ice keels is listed together with their mean draft and draft distribution. Definitions are found to be of overriding importance in the comparison of data from different areas.

WILLIAMS J. J., D. C. CONNER and K. E. PETERSON, 1975. Piper oil field, North Sea: Fault-block structure with Upper Jurassic beach/bar reservoir sands. *Am. Ass. Petrol. Geol. Bull.*, 59 (9): 1585-1601.

Piper field discovery well, 15/17-1a, drilled through 192 feet (52 m) of oil-bearing Upper Jurassic sandstone on December 22, 1972. Subsequent appraisal wells delineated approximately 8,600 productive acres with an estimated 1.55 billion bbl of 36° API gravity low-sulfur oil in place and 650-900 million bbl recoverable.

Reservoir sandstones are Oxfordian and early Kimmeridgian in age, of marine origin, and unconformably overlie a nonmarine Middle Jurassic sedimentary sequence. The gross-reservoir thickness averages 250 feet (76 m) in the field area and is comprised of several individual sandstone bodies 40 - 70 feet (12 - 21 m) thick. With individual sandstone bodies the grain size grades either upward or downward from very fine sandstone or siltstone to coarse-grained sandstone. The sandstones generally are well sorted, highly bioturbated, friable, and have excellent porosity and permeability. Individual sandstone bodies record local regressions or transgressions. Regressive sands, accreting seaward as foreset beds, were generally thicker than transgressive sands.

Isopachs of Triassic through Cretaceous units suggest that the Piper structure grew intermittently before, during, and after deposition of the reservoir sands. Post-Albian-pre-Turonian/Coniacian faulting and erosion and rejuvenated faulting during pre-Maastrichtian Late Cretaceous time formed a series of eroded and tilted fault blocks. The domal structure mapped at the base of the Tertiary is not evident in the younger horizons because of the masking effect of middle Tertiary deltaic deposits. Regional subsidence continued throughout the Tertiary and formed the present North Sea basin.

WILSON T. R. S. and A. J. HARRISON, 1975. Submerged-pump systems for underway monitoring at the sea surface, using a conventional STD or CTD unit. *Deep-Sea Res.*, 22 (8): 571-574.

A low-cost system is described for circulating surface seawater rapidly through a deck tank while the ship is under way. The tank is designed to hold a Plessey 9040 sea unit; the output from this device is recorded in analog and digital form continuously between stations, thus increasing the usefulness of this relatively expensive instrument. Over 4000 n mi of surface records have been obtained using this system. A simple assembly which permits single point calibration samples for shallow casts to be taken by sampling bottle attached directly to the sea unit is also described.

WITHERS R. G., W. F. FARNHAM, S. LEWEY, N. A. JEPHSON, J. M. HAYTHORN and P. W. G. GRAY, 1975. The epibionts of *Sargassum muticum* in British waters. *Mar. Biol.*, 31 (1): 79-86.

This study was motivated by suggestions that the Japanese brown alga *Sargassum muticum* (Yendo) Fensholt, recently found to be invading shores along the eastern Solent (Southern England), might replace certain common native plants, to the possible detriment of local epibiont communities. Eighty animal, 52 plant and 9 fungal species have been identified from *S. muticum* plants collected at four different localities. Animal fouling was most conspicuous on permanently submerged plants growing along the edge of floating harbour installations. Algal epibionts were most numerous and varied on *S. muticum* from tidal lagoons on a well-scoured

but sheltered rocky shore. Most of the epibionts colonised the perennial portions of the plants, close to the holdfast. A few settled along the fronds in summer, but none were found in the region of the secondary and tertiary apical meristems. Seasonal variations in the abundance and diversity of algal epibionts were observed; most were restricted to summer, but winter and all-year-round species were also noted. Fungal studies on *S. muticum* have isolated only saprophytic species, which are also common locally on other Phaeophyceae. Overall, these data suggest that *S. muticum* can support a considerable epibiota and, therefore, its introduction seems unlikely to result in a significant change in local epiphyte communities.

YAMAGUCHI MASASHI, 1975. Estimating growth parameters from growth rate data: problems with marine sedentary invertebrates. *Oecologia*, 20 (4): 321-332.

The time interval over which growth rates are measured modifies the observed growth rates in non-linear growth curves. Growth rates obtained from a sigmoid curve such as the logistic growth equation may appear to be derived from the non-sigmoid von Bertalanffy growth equation when the small stage is not represented in the hypothetical growth observation. The inflection point of a sigmoid curve may be underestimated in non-instantaneous growth rate data when they are plotted on a graph against the initial sizes. This problem is significant for marine macro-benthos, whose growth is likely to be sigmoid and initiates mostly at microscopic sizes, when the popular von Bertalanffy growth equation is fitted to the observed growth rate data. Even when the von Bertalanffy growth equation appears to represent the observed growth rates adequately, extrapolation of the equation toward the smaller stage may require an independent investigation.

YOUNG P. C. and H. KIRKMAN, 1975. The seagrass communities of Moreton Bay, Queensland. *Aquat. Bot.*, 1 (2): 191-202.

In this paper the composition of the seagrass communities of Moreton Bay, Queensland, is described. Six species were found: *Zostera capricorni* Aschers., *Halodule uninervis* (Forsk.) Aschers., *Halophila ovalis* (R. Br.) Hook. f., *Halophila spinulosa* (R.Br.) Aschers., *Cymodocea serrulata* (R.Br.) Aschers. and Magnus and *Syringodium isoetifolium* (Aschers.) Dandy. These were found in five different distinct phanerogamic communities: two monospecific communities, one multispecific community, a community characterised by a single dominant species, and a community in which two species were of equal importance. The zonation of these was determined by depth, salinity, turbidity and substrate characteristics. It is postulated that the absence of *Posidonia* has enabled various species to co-exist and remain intact instead of being part of a series leading to a *Posidonia* meadow.

YOUNGBLOOD W. W. and M. BLUMER, 1975. Polycyclic aromatic hydrocarbons in the environment: homologous series in soils and recent marine sediments. *Geochim. cosmochim. Acta*, 39 (9): 1303-1314.

Soils and recent marine sediments contain a complex polycyclic aromatic hydrocarbon assemblage. The many series of alkylhomologs have a similar molecular weight distribution, and it varies little over a wide range of depositional environments. It is suggested that these hydrocarbons are formed in natural fires, are dispersed and mixed by air transport and eventually deposited into surface sediments.

YOUNGBLUTH M. J., 1975. The vertical distribution and diel migration of euphausiids in the central waters of the eastern South Pacific. *Deep-Sea Res.*, 22 (8): 519-536.

The range and complexity of variation in the vertical distributions and diel migrations of oceanic euphausiids from the central gyre in the eastern South Pacific have been examined. Five to nine depth intervals at six day-night stations were sampled during November - December 1970. Several opening-closing Bongo nets were towed simultaneously through 50- to 100-m strata in the upper 700 m. Twenty-seven species from 5 genera were identified from 94 hauls. The vertical distribution patterns of 19 species were associated with environmental gradients and differed according to time of day, locality, and age structure of the population. The extent to which these patterns serve as a model for other groups of vertically migrating organisms is discussed.

ZENK WALTER and E. J. KATZ, 1975. On the stationarity of temperature spectra at high horizontal wave numbers. *J. geophys. Res.*, 80 (27): 3885-3891.

Two examples of high wave number (one cycle per 5 m to one cycle per kilometer) temperature spectra from constant depth tow segments are presented. The first is from observations in the center of the main thermocline of the northwest Atlantic at a depth of about 700 m. Four independent estimates of the spectrum are statistically similar to one another. The result is continuous with previous results at lower wave numbers and compares favorably with the 1975 Garrett and Munk internal wave model prediction. The second example is from a tow through a surface mixed layer, at a depth of 26 m, in a nearby area. In contrast to the above, it describes the lack of stationarity of the near-surface spectrum; a result reminiscent of the frequency spectra observed by Sabinin.

ZIEMAN J. C., 1975. Seasonal variation of turtle grass, *Thalassia testudinum* König, with reference to temperature and salinity effects. *Aquat. Bot.*, 1 (2): 107-123.

Although turtle grass, *Thalassia testudinum* König, is a tropical marine plant, studies show it undergoes seasonal fluctuation. Maximum values of productivity, standing crop, leaf length, blade density, and other biotic variables are reached in the warmer summer months. *Thalassia* has a temperature optimum near 30°C and a salinity optimum near 30 ‰. Significant deviations of these environmental parameters from their optima depress the biotic viability of the plant. Minimum values for the measured variables were encountered during periods of seasonally low temperatures or high temperatures coupled with lowered salinity. *Thalassia* is seen to have a slow response to environmental stress due to the stored starch reserves in the extensive robust rhizome system.

ZIRINO ALBERTO, 1975. Measurement of the apparent pH of seawater with a combination microelectrode. *Limnol. Oceanogr.*, 20 (4): 654-657.

A method for precisely measuring the apparent pH of seawater, using a microelectrode and a specially designed cell, is described. The cell requires a 25-ml sample, reaches equilibrium in 6 min or less, and its precision in routine use at sea was ± 0.0026 pH units.