

Nature et fonctionnement des atolls des Tuamotu (Polynésie Française)



The 77 atolls of the Tuamotu Archipelago (French Polynesia) constitute bio-geomorphological singularities in the oligotrophic oceanic field of the South Pacific. These open-ocean atoll reefs are locally overlaid by sandy islets (motu) and encompass lagoons with hydrological properties that are different from oceanic water, according to their degree of enclosure. Lagoonal waters may be more or less saline and eutrophic than oceanic water. In eutrophic lagoons, corals are replaced by macro-algae and cyanobacterial mats. At the archipelago scale, invariance in the geomorphologic patterns of the atoll reefs, despite differences in age (1 to 50 million years) and in size (2 to 1600 km²) underline functional similarities which appear to be independent of surface oceanic constraints. Data gathered from boreholes and their interstitial waters and in several atoll subdivisions (barrier reef, pinnacle, motu, lagoon) show high contents of dissolved nutrients and CO₂. Anomalies in the vertical distribution of conservative parameters (salinity, He-3, CFC) indicate that reef interstitial waters are recharged from the Antarctic Intermediate Water (AIW). A second component comes from direct injection of surface tropical water (STW) by surge waves which preserve the high porosity-permeability of the reef rim and allow its oxygenation. An evaluation of the nutrient budgets obtained by drawing the mixing lines AIW/STW shows that half the nutrient content of the interstitial waters is brought up by internal vertical advection which provides new nutrients; the other half is regenerated in situ. These data tend to confirm the validity of the model of reef/atoll functioning by geothermal endo-upwelling. This process controls, by a thermo-convection of the interstitial reef water, the arrival of new nutrients in the photic layer to support the high productivity of autotrophic systems, which in this case are alga-coral communities. The endo-upwelling also has a hydrothermal component which confers great stability and makes it possible to take into account different processes of alteration and cementation in each of the atoll's subdivisions. Recent lethal coral bleaching events in Polynesia may be linked to a temporary breakdown of the interstitial thermo-convective flux in consequence of the abnormal ocean warming, and be viewed as a harbinger of coral-reef decay.

Auteurs du document : Rougerie, F

Obtenir le document : Gauthier-Villars

Thème (issu du Text Mining) : MILIEU NATUREL

Date : 1995

Format : text/xml

Source : Oceanologica Acta (0399-1784) (Gauthier-Villars), 1995 , Vol. 18 , N. 1 , P. 61-78

Langue : Inconnu

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