LA SEDIMENTATION Marine

GENERAL

The marine domain is defined in opposition to the continental domain. Their most characteristic features are the extent of their surface and the saltiness of their water. Its salinity is quite homogeneous and close to 36 per thousand.

1. GENERAL CHARACTERISTICS

coastal marine organisms proliferate and precipitate the calcium ion taken from seawater in the form of carbonate which accumulates because it is less soluble in warm waters.

Calcium carbonate is in the form of aragonite, calcite, magnesium calcite (containing a variable amount of $MgCO_3$) and dolomite (Ca,Mg) CO_3.

2 COASTAL ZONATION AND SEDIMENTATION

2.1 General provision

The coastal platform is generally cut by a barrier parallel to the coast, which isolates a protected internal platform from an external platform subject to wave action. As on beaches with silico-clastic sedimentation, the swing of the tides determines the supra-, inter- and sub-tidal zones.

Le cas des atolls du Pacifique est particulier; la barrière de récif ceinture l'île et isole une plate-forme interne annulaire; si l'île s'enfonce, ou le niveau général de la mer monte, la barrière isole un lagon circulaire.

2.2 The internal platform

Hydrodynamics is low, it increases at high tide, when the waves cross the barrier, and opposite the passes. The intertidal zone corresponds to a medium to low energy level. Medium to coarse debris and oolites are deposited in tidal channels. In the upper part of the intertidal zone, crusts or algal constructions (stromatolites) can develop. The supratidal zone can include aeolian dunes, swamps and lagoons with an evaporitic tendency (coastal sebkha). The subtidal zone is a very calm settling environment; A limestone mud is deposited there.

2.2 The internal platform

Hydrodynamics is low, it increases at high tide, when the waves cross the barrier, and opposite the passes. The intertidal zone corresponds to a medium to low energy level. Bioclastic sand accumulates on the beach, made up of remains of skeletons and limestone shells. Medium to coarse debris and oolites are deposited in tidal channels. In the upper part of the intertidal zone, crusts or algal constructions (stromatolites) can develop. The supratidal zone can include aeolian dunes, swamps and lagoons with an evaporitic tendency (littoral sebkha). The subtidal zone is a very calm settling environment; a limestone mud is deposited there.

2.3 The barrier

The corals usually build the barrier; it is covered at high tide but partially emerged at low tide; it is locally interrupted by passes which put the internal platform in communication with the open sea and which allow navigation. The coral reef represents a complex bioconstruction whose framework is made up of the corals themselves It settles generally on a solid support, in warm, agitated, clear and shallow waters: Turbid waters prevent the development of corals: the Great Australian Barrier is interrupted at the mouths of coastal rivers.

2.4 The external platform

The energy on the bottom is average in the wave action zone. From a certain depth, around fifty meters, the hydrodynamics are very weak. The sediments are deposited according to this energy gradient: coarse elements near the barrier, calcareous or clay-carbonate mud offshore.

3. NERITIC CARBONATE ROCKS

The majority of carbonate rocks the geological series come from the lithification of coastal carbonate sediments.

3.1 Lithification of the sediment

The diagenesis of carbonate sediments begins very early. It includes two main aspects: (1) cementation, (2) isochemical transformation of elements or neomorphism. Changes in chemical composition lead to silicification or dolomitization of the rock.

In the supratidal zone and the continental realm, the pores of the sediment are alternately filled with fresh water or air in the vadose zone or constantly filled with fresh water in the deeper phreatic zone.

* In the vadose zone, the carbonate precipitates in the voids first in the form of gravity (or stalactitic) cement on the underside of the grains and of meniscus cement between the grains. The precipitation continues in the form of low-magnesian calcite in large irregular crystals (drusic sparite) which can develop syntactically (in continuity with the crystal lattice of the element surrounded by the cement: this phenomenon mainly affects echinoderm debris).

* In the phreatic zone, the cement is initially isopachous, in a fringe around the grains; the sparite then fills the voids.

In the intertidal zone, beach sands are cemented by acicular crystals of aragonite and magnesian calcite; the cement is isopachous in the marine phreatic zone; it is in meniscus in the vadose zone.

In the subtidal zone, acicular crystals of aragonite and small crystals of magnesian calcite fill the cavities of the calcareous fragments of organisms.

Cementation phenomena continue during burial; sparitic calcite precipitates in the pores. The crystals change shape and structure by recrystallization (neomorphism): replacement of aragonite/calcite, fibrous calcite/micritic calcite, recrystallization of skeletal grains3.2 Structures of carbonate rocks

Bivalves and gastropods are numerous in coastal environments and contribute greatly to carbonate sedimentation.

Planktonic foraminifera play a large role in pelagic sedimentation (see next chapter). Benthic foraminifera often clump together the sediment.

Corals and bryozoans build bioconstructions that provide debris of all sizes. Green and red algae and cyanobacteria precipitate calcium carbonate into small crystals (micrite) which form real bioconstructions or provide fine parts to the sediments.

Non-skeletal grains include ooids, peloids, aggregates and intraclasts.

Ooids are millimetric spherical grains composed of one or more layers around a central nucleus. Oolites have concentric lamellae, pisolites are larger oolites of centimeter size. Coated grains have only one layer around the core. Ooids with radial structures are also called spherulites.

Peloids are rounded or elongated grains, sometimes angular, formed of microcrystalline carbonate (micrite). Many are droppings from living beings, such as gastropods and crustaceans: these are then pellets. Other peloids come from the transformation of bioclasts into micrite.

Intraclasts are fragments of partially lithified carbonate sediment. Aggregates are particles agglomerated by micritic or organic cement.

b) Carbonate mud

In limestone rocks, the grains are often surrounded by a microcrystalline limestone phase, micrite, which corresponds to a mud deposited at the same time as the grains. This mud is generally produced by the disintegration of algae fixing the limestone, the erosion of bioconstructions by perforating organisms and the mechanical wear of the grains by the agitation of the algae;

3.3 Classification of limestone rocks

Several classifications are used.

a) “Detrital type” classification: it is based on the size of the grains: calcirudites (> 2mm), calcarenites (between 2 mm and 62 µm) and calcilutites (> 62 µm).

b) Folk classification, based on the nature of the grains (or allochems), the matrix and the cement.

c) Dunham classification, distributing rocks according to their texture, i.e. the respective arrangement of grains and the quantity of matrix or cement.

(Classification de Dunham, répartissant les roches d'après leur texture, c'est à dire la disposition respective de grains et la quantité de matrice ou ciment).

3.4 Limestones in geological series.

Although numerous stromatolites, often large, are known in the Precambrian series, large carbonate platform deposits begin in the Cambrian. Bioconstructions are built by colonial organisms

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