Glaciomarine Sediments from Southern Argentina Continental Shel. Preliminary Note

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INTRODUCTION

The late Quaternary knowledge of the Argentina continental shelf has been the objective of large number of studies specially developed during the last two decades.

Some researches were devoted to the analysis of surface sedimentary cover, based on a large number of bottom and core samples, giving as a consistent result, sedimentological maps like those published by Urien (1970), Servicio de Hidrografia Naval (1974), Urien & Martins (1974 a, 1979), Martins & Urien (1979) and Urien et al. (1992). A synthesis of the eastern South America Quaternary costal and marine geology was made by Martins & Villwock (1987).

Several portions of the continental shelf, such as the sedimentary model of the Buenos Aires province (Urien et al., 1979), the Rio de La Plata history during the Late Quaternary (Urien & Ottmann, 1971), the sedimentation adjacent to the Rio de La Plata (Ayup-Zouain, 1988), the Wisconsin sea level, (Fray & Ewing, 1963), the aligned shoals in the Punta Medanos area (Parker & Violante, 1978; Parker et al., 1982), the Bahia Blanca sector (Gelôs et al., 1987; Gelôs & Chaar, 1988), the Megellan strait and Beagle channel Holocenic levels (Porter et al., 1984; Rabassa et al., 1986), the paleogeographic evolution of the Buenos Aires area (Urien & Ewing, 1974; Urien & Martins, 1979; Martins & Urien, 1979; Urien & Martins 1987, 1989) and the morphology and glacigenic sediments of Tierra del Fuego (Isla & Schnack, 1989; Isla & Bujaleski, 1990; Isla et al., 1991), were studied with some details.

The present preliminary note, has the purpose to discuss the main results obtained trough the study of bottom and core samples, camera stations, seismic and bathymetric profiles gathered on the austral portion of the Argentina continental shelf, in a situation where the influence of the glacial and periglacial processes and materials impress to the sedimentary system an unique characteristic, not found along other sectors of the continental shelf. The geological samples were analysed through the classic methodology summarized by Martins et al. (1978).

A high resolution EG & G dual side scan sonar, an EDDO 3.5/7.0 KHz sub bottom profiler and an Alpine 311 underwater camera were used to obtain additional information regarding the shelf bottom. For comparison, bottom photographs and data from Eltanin cruises, were obtained from the United States Antarctic Research - USARP (Jacobs et al., 1970, 1972; Goodell, 1964).
The studied area is located approximately between the latitudes 50° to 55° S and longitudes 62° to 69° W, in the Tierra del Fuego region (Fig. 1).

The analysed material was obtained through missions accomplished by Lamont-Doherty Geological Observatory (USA) and the Servicio de Hidrografía Naval (Argentina), and this study represents part of a cooperative research project established between the Centro de Oceanografía of Instituto Tecnológico de Buenos Aires - COBA/ITBA (Argentina) and the Centro de Estudos de Geologia Costeira e Oceânica, of the Universidade Federal do Rio Grande do Sul - CECO/
deposited during periods when the continental shelf was not a modem contribution, but was mainly reworked. All this coarse material represents a significant contribution of coarse detrital sediments including sands and gravels that occupies a well developed belt, bordered by fine sediments on the inner shelf and along the outer shelf and slope is remarkable. The presence of an extremely high energy conditions gives to the sedimentary covering a gravelly sand texture, prevailing over the fine sediments.

Sediments from glaciers, ice and grounded sheets that enter the shelf are more or less reworked on the sea floor, were identified and described as glaciomarine by Phillippin (1912). They are usually crudely sorted detrital sediments including gravels and sands, silt and clay, and biogenic material. Glaciological and oceanographic processes and the sea bed characteristics will control the pattern of the glaciomarine sedimentation, and a lithofacies classification for this type of deposits based upon a suite of properties such as grain size, fabric, internal structure and bed contact relationships can be used (Drewry, 1987).

A general distribution of the sedimentary textures occurring at the studied area is shown in the map of the Figure 2. The dominance of coarse components come out by sands and gravel that occupies a well developed belt, bordered by fine sediments on the inner shelf and along the outer shelf and slope is remarkable. All this coarse material did not represent a modern contribution, but was mainly reworked during periods when the continental shelf was exposed during the Pleistocene, specially at the Wisconsin sea level, when a succession of deposits linked with glacial and periglacial events were responsible by the transportation and deposition of these materials.

Over the then exposed continental shelf, terrestrial glacial deposits such as till and outwash were easily weathered eroded and reworked. Submerged moraines in the Tierra del Fuego continental shelf were identified at a depth of 50 meters (TOTAL AUSTRAL GEOMATTER, 1980). The reworking processes was chiefly conducted during the Holocene transgression and its associated still–stands that generates high energy coastlines and a winnowing of the fine fractions.

Studying the sediment distribution of the sedimentary cover of the South America continental shelf between Cabo Santa Marta (Brazil) and Tierra del Fuego (Argentina), Urien & Martins (1974) divided the area on five distinct zones according to age, source and textural properties of the sediments.

The Tierra del Fuego continental shelf is characterized by an irregular and abrupt topography with the occurrence of several shoals mainly linked with a previous morphology acquired during lowered sea–level (relict features), or developed through Holocene processes during the sea–level rise or as it occurs on its inner portion across the present hydric conditions (modern features).

Isla et al. (1991) noted that in the northeastern of Tierra del Fuego, the Holocene mean sea–level fluctuation reworked much pre–Wisconsin glacial drift into sand/gravel beaches and spits and sand/mud tidal flats. The presence of an extremely severe energy conditions gives to the sedimentary covering a gravelly sand texture, prevailing over the fine sediments. Sediments from glaciers ice and grounded sheets that enter the shelf, were identified and described as glaciomarine by Phillippin (1912). They are usually crudely sorted detrital sediments including gravels and sands, silt and clay, and biogenic material. Glaciological and oceanographic process and the sea bed characteristics will control the pattern of the glaciomarine sedimentation, and a lithofacies classification for this type of deposits based upon a suite of properties such as grain size, fabric, internal structure and bed contact relationships can be used (Drewry, 1987).

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Recent studies, Isla & Schnack (1989), using high resolution seismic methods and side–scan sonar profiles, identified between 30 and 80 meters, a set of bottom features and outcrops stratigraphic units, mainly connected with the ice retreat and sea level rise. The authors mapped two aligned moraines, associated with glaciogenic deposits, that originates submerged beaches, sand waves and strips oriented according the tidal currents activity along the Magellanic strait.

In fact, a large part of the Tierra del Fuego continental shelf is covered by relict sediments on unbalance situation with the hydraulic conditions prevailing today. However, the sea–level rise during the Holocene and its temporary still–stands, generates a series of coastlines (as the two ones that were identified and dated in the present research), with a high energy level sedimentation and responsible by the reworking of these materials and promoting a sedimentary palimpsest type of covering.

The map showed in the Figure 3 presents the main bottom features obtained through camera stations, as well as a dynamic interpretation in terms of type of sediments. The study identified old deltas, drowned at present, mainly connected with ancient fluvial activity. These features, were submitted to a high expressive tide/wave energy that reworked sediments from tills and outwash plains.

The present sediment contribution are small and restricted to fine sediments that carpet the inner shelf.

The wide sandy cover is attired predominantly by ripple marks and formed by reworked relict neritic sediments.

A sandy mud strip covers the outer shelf and represents an old neritic zone on a stage of lower sea–level (probably during the Wisconsin) and is relict, but was deposited on conditions similar to those found along the inner shelf of the present coastline. This outer zone changes to muds, that dominates on the continental slope.
Regarding the coastal area, Isla & Bujaleski (1990) indicates that the Quaternary and modern beach deposits are quite different at the north and south regions of Tierra del Fuego. At the north, gravel spits and extended beaches induced by longshore currents are present, while at the Beagle channel the beach material is mainly formed by shells and terrigenous angular clasts. Different wave energy and tidal range (up to 10 meters at the Atlantic coast and less than 1 meter in the channel), plays also a significant role on the sedimentation processes and consequently on the sedimentary coastal forms and sediments along the two distinct areas.

**FACIES DISTRIBUTION**

The lithofacies distribution of the southern Argentina continental shelf is synthesized in the map of the Figure 4, that indicates the following types:

a) inner shelf (nearshore muds) composed by fine sediments of modern contribution or reworked from old deposits;

b) middle/outer shelf (sands) dominantly formed by terrigenous sands and gravels with its source linked with glacial and periglacial activity (direct ice action or fluvioglacial) that dominates along the area during lower stages of sea-level retreat (Pleistocene) and reworked on several grades during the Holocene transgression;

c) outer shelf/shelf border (sandy muds) also relict and represented by fine sediments similar to those found on the inner shelf forming an old sedimentary environment that was governed by the same parameters that are acting along the present coastline, but on a low stillstand (Wisconsin);

d) slope (muds - slope muds and deep clinoform muds) formed by a thick mud deposit with clinoform or prograding characteristics that modelling the slope during regressive periods, specially developed from Late Tertiary through Early Quaternary.

**PALEOGEOGRAPHIC REMARKS**

During the Holocene transgression, and associated with sea-level still-stands, a set of deltaic fronts were developed over conglomeratic planes of glacial origin built during Upper Tertiary and Pleistocene lower sea-level, as showed at the Figure 5.

The widespread of these features, is mainly related to a strong combined action of waves and tidal currents. Besides that, two relict coastlines were identified through the mechanical and mineralogical aspects of the sediments high resolution seismic profiles, associated biogenic components, and C14 dated; one at -157 meters (18.000 years BP) and other at -119 meters (12.000 years BP).

This partial paleogeographic reconstruction of the studied area is not conclusive and needs a number of new information coming from data and samples of which processing is running through the present research project. Nevertheless the work developed at the glacial and periglacial activity and related deposits were the leading supplier of sedimentary material to the continental shelf during its exposition times at Upper Tertiary and Pleistocene lower sea-level.

The Holocene transgression and still-stands creates a
series of temporary coastlines, that reworked these materials under a strong action of waves and tidal currents, that were responsible for the dispersion of the glaciogenic sediments.

REFERENCES


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