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Evolution of the Holocenic Shoreline Santa Catarina State, Brazil: A Discussion

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ABSTRACT

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Located Southeastern Brazil, Santa Catarina state has a littoral with a variety of coastal environments. Beaches, estuaries, bays, bights, barriers and other coastal environments are disposed along 538 km of coastline (about 7% of the Brazilian coast). Coastal strandplain, has long served as a natural laboratory for the research of Coastal Depositional System and evolution in response to relative sea level changes/neogeotectonic model. The configuration of the Santa Catarina's shoreline since the last Post-Glacial at present is result: prograded coastal barrier (Holocene regression), geological inheritance: influence of antecedent topograph (rocks of the Basement and sedimentary deposits), sediment supply, substrate gradient, sediment budget and neotectonism.

ADDITIONAL INDEX WORDS: *Regressive sequence, coastline build, sea level changes.*

INTRODUCTION

Santa Catarina State, located in Southern Brazil, is limited by the Saí-Guaçu River (lat. 25º57'41" South) and the Mampituba River (lat. 29º23'55" South). Santa Catarina littoral is 561km long. The littoral zone has various distinct geomorphological features, including islands, bays, bights, lagoons, dunes, beaches and caps (about 7% of the Brazilian coast). Classified as a shoreline dominated by waves according to DAVIES and HAYES (1984).

This littoral area can be divided into two zones according to the coast orientation: the central-north littoral and the southern littoral. The first region between Laguna and Itapoa, is predominantly South-North oriented. The second region, located between Laguna and Torres , extends in a Northeast-Southwest direction.

Three sectors, Northern, Central and Southern, were identified by MARTIN *et al.*(1988). The Northern sector extends from Saí-Guaçu River to Barra Velha beach (lat. 26º40' South). This sector , located between the Atlantic Ocean and the foot of the Serra do Mar and Serras do Leste Catarinense escarpments, is characterized by a wide coastal plain. Two characteristic features in this sector are the São Francisco do Sul Island and the Babitonga Bay. The Central sector is situated between Barra Velha and Garopaba beaches (lat. 28º South). This sector is characterized by the proximity of the Crystalline Basement to the ocean, narrowing the Coastal Plain. Porto Belo Peninsula and Santa Catarina Island are two of the most important features. The Southern sector, which is distinguished by an extensive coastal plain, shows several large and elongate paleolagoons and lagoons.

The geology of the Santa Catarina state is characterized by two major provinces: the Basement and the Coastal Plain. Basement is dominated by granite-gneissic rocks from the Escudo Catarinense, sedimentary rocks from Bacia do Paraná and basalts from Serra Geral Highlands. These rocks and the Continental Shelf have been the source area for sediments to the adjacent coastal zone. From its Northern limit South, the Coastal Plain is influenced by metamorphic rocks of various metamorphic degrees, granites and some meta sedimentary formations of the Crystalline Basement. In its Southern part, the Coastal Plain deposits are adjacent to sandstones, mudstones, claystones and shales from Bacia do Paraná, as well as basalts from the Serra Geral Formation.

The Coastal Plain deposits have been worked by the relative sea level oscillations during the Holocene. These deposits are related to those listed in Paraná Coastal Plain (ANGULO, 1992), and Rio Grande do Sul Coastal Plain (VILLWOCK *et al.*, 1986). Trans-regressive events during the Holocenic climax good generated the Laguna-Barreira IV depositional system (VILLWOCK *et al.*, 1986). These deposits are intimately associated, either by an abrupt or interfingering contact, with pleistocenic deposits, Tertiary and Quaternary fan deposit. Some shell middens found in the Coastal Plain are settled on pleistocenic and holocenic deposits.

Are belive that such focus on the study of a segment of the coast will enable us to generate criteria for the acquisition of activities that are adequate for the integrated coastal managing, coming in opposition to the current stereotype of occupation present along of the Santa Catarina littoral.

RESULTS

The ocean and continent cover of the Earth's surface is 71% to 29%, respectively. According to MÖRNER (1996), the point where the ocean surface and the continent surface cross each other is known as the shoreline (or coast, in general). This point is not fixed in time and space but continually changes. Changes are caused by by four main factors: (1) vertical changes in the ocean level (eustasy, dynamics); (2) vertical changes in the land level (tectonics, compactation); (3) re-shaping of the coastal morphology (erosion/deposition); (4) changes in sea/land interaction (tidal range, wind direction, waves energy, etc.). Rate factors include long-term (a century or more) components, short-term (annual to decanal) components, and even instantaneous components.

Tectonically, there does not exist any "*stable*" point or area (e.g., NEWMAN and MUNSART, 1968; MÖRNER, 1983).

Holocenic Shoreline

Seismotectonics may generate instantaneus changes in the land level. Where particularly if the uplift rate is rapid, impossible backbarrier and lagoonal deposits to develop, but the sediment supply from alongshore and offshore adjusted as base level changes, formerly unavailable, deeper lying sediments may be tectonically lifted into the active shoreface zone; and favoring wide swash areas for subsequent eolic reworking for progradation of the coastal plain.

Many models don't accept the neotectonism addition to the coastal evolutionary model, in that some cases and of first order and cause. This factor was unnoticed, but now it is of crucial importance, for the understanding of the evolution of regressive shorelines in the south of the Brazil.

Beach deposits will only form when the substrate gradient is 0.05° and 0.8°. Shallow shelves (<0.05) frictional wave shoaling decreases wave energy to the point where there is insufficient energy to form a beach profile and subaqueous

shoals and tidal deposits result. Other vision gradients (>0.8°) sediments are transported until deposited in the shoreface. Shorelines, consequently progradation barrier, are therefore developed on gradients 0.05º and 0.8°, and optimum beach development on a gradient of 0.1°; this is confirmed of Santa Catarina strandplain.

Texture, mineralogy, size, inputs of rates of sediment supply will depend regional geology and climatic changes. However, wave energy, tide and winds of onshore are the processes of larger importance of construction the holocenic shoreline. Related processes which ultimstely transport the sediment to the shoreface, and eolic positive load which build capping foredunes strandplains and beach ridges. Source of sediments is intimately related with the local geology of each segment of coastline and yours structural involvement; provenience: reworking shelf paleodeposits; sediments originate from abrasion of adjacent rockyshores, river sediments. Sediments are not only fundamental for shoreline formation, but their constant input of supply will contribute to stability.

Stability of coastline is largely dependent on the sediment budget, with a positive beach budget leading to shoreline progradation, a negative budget to retrogradation, while a balanced budget may tend towards shoreline stability.

Coastal bedrock and rock litology will influence barrier development through controls on sediment supply, and substrate gradient (occupation of accommodation space). Sedimentary deposits of Upper Pleistocene and rockshores of Basement; will favour the development of embryos shoreline in the Santa Catarina state, being anchored to the pre-existent deposits.

Holocene vertical sequence of facies (5 Ka - today) evidence clearly a progradation. Induced mainly by satisfactory sedimentary supply coming of the drainage, mantles of aspersion eolic and platform. Sediments so much of first cycle sedimentar (fragments of rocks of the Basement) as of successive cycles (paleoshorelines).

DISCUSSIONS

The configuration of the Santa Catarina's shoreline since the last Post-Glacial at present is result: prograded coastal barrier (Holocene regression), geological inheritance: influence of antecedent topograph (rocks of the Basement and sedimentary deposits), sediment supply, substrate gradient, sediment budget and neotectonism.

Regressive deposits accumulated as the foredunes and beach ridges where aligned with the actual shoreline (stranplain).

Progradation (regressive sequences) associated with slowly rising or stationary sea levels in association with abundant sediment supply, lower substrate gradient and favorable oceanographic conditions (waves, tides, winds).

Morphostratigraphy of the coastal plain reveals the survival of progradacional deposits build at last two interglacials, 120 and 5 Ka, Late Pleistocene and Holocene, respectively. For the beginning of the Holocene period, 5 Ka interpreted sea level elevations range from 2.5 m to 0 m relative to present. Late Pleistocene sea level was positioned 5m above the current level. The sustained and detailed development will allow for the preservation of the shoreline its distinct beaches, which makes up one of the most beautiful landscapes of the Brazilian coast. Continuity of this inquirys, including sub-surface stratigraphy also (coastal coring and Carbon 14 - AMS) and detailed Holocene geological comparative studies are recommended to the present area. Harmonizing the potential of the different uses provided by this region to the geological, geomorphological, oceanographic, biological characteristics becomes of a great urgency. Before the exposed above, it is of great importance the establishment of management proposal that will have as its goal the definition of new rules in the environmental management, as well as determination the vocation of the different coastal segments, which must be in accordance with their original characteristics.

LITERATURE CITED

ANGULO, R.J. 1992. *Geologia da Planície Costeira do Estado do Paraná.* Tese (Curso de Pós-Graduação em Geociências), Universidade de São Paulo, 334p.

DAVIES, R.A. and HAYES, M.O., 1984. What is a wave-dominatec coast? *Marine Geology*, 60, 313-329.

MARTIN, L.; SUGUIO, K.; FLEXOR, J.M. and AZEVEDO, A.E.G. de. 1988. *Mapa Geológico do Quaternário Costeiro dos Estados do Paraná e Santa Catarina*. Série Geologia. Seção Geologia Básica. DNPM: Brasília, 2 mapas. 28:1-40.

MÖRNER, N.-A., 1983. Sea Levels. In: Gardner, R. And Scoging, H., (eds.), Mega-Geomorphology. Oxford: Oxford University Press, pp.73-91

MÖRNER, N.-A., 1996. Rapid Changes in Coastal Sea Level. *Journal of Coastal Research*, 12(4), 797-800.

NEWMAN, W.S. and MUNSART, C.A., 1968. Holocene geology of the Vacha-preagne lagoon, eastern shore peninsula, Virginia. *Marine Geology*, 6, 81-105.

VILLWOCK, J.A.; TOMAZELLI, L.J.; LOSS, E.L.; DEHNHARDT, E.A.; HORN FILHO, N.O.; BACHII, F.A. And DEHNHARDT, B.A., 1986. Geology of the Rio Grande do Sul Coastal Province. *Quaternary of South America and Antarctic Peninsula.* A.A. Balkema: Rotterdam. (4): 79-97.