VI Simpósio Nacional de Geomorfologia / Regional Conference on Geomorphology
Geomorfologia Tropical e Subtropical: processos, métodos e técnicas / Tropical and Subtropical Geomorphology: processes, methods and techniques
Goiânia, 6 a 10 de setembro de 2006 / Brazil, Goiânia-GO, September 6-10, 2006

SANDY DEPOSIT ESTABLISHED IN FRONT OF TOPOGRAPHICAL OBSTACLE ON PRAIA MOLE – SANTA CATARINA ISLAND SOUTH OF BRAZIL: CLIMBING DUNE OR SANDY RAMP?

PAISANI, J.C.[1]

[1] Universidade Estadual do Oeste do Paraná / Campus Francisco R. Maringá, 1200, Francisco Beltrão (PR), CEP 85.605.010. (046xx) 3524-1661 e fax (046xx) 3523-0011 juliopaisani@hotmail.com

RESUMO

Climbing dunes have been being recognized in different sedimentary environments in the tempered and tropical regions. In tropical coastal and subtropical areas, some authors designate them *sandy ramp*. On the other hand, the sandy ramp term was proposed for Bigarella (1974) to refer to the climbing dune discharacterized morphologic and structurally along the Quaternary in coaste south of Brazil. In Santa Catarina Island there are divergencies regarding the definition of the sandy deposits found in front of topographical obstacle. The present article introduces the stratigraphy of the deposit found in front of topographical obstacle on Praia Mole, Santa Catarina Island – South of Brazil, defining if it corresponds to the climbing dune or sandy ramp, contributing for the differentiation between both. The stratigraphic sequence of the area was defined correlating 14 column sections organized along 02 topographical profiles in the sense E-W and S-N. The beds were identified indirectly by means of granulometrical diagraphy, whose procedures are detailed by Paisani (2004 a, b). The beds with mixture sediments between aeolian and of hillside were designated dissipation facies'. The individualization of the aeolian facies and of dissipation facies was sent by the analysis of the superficial texture of the quartz grains of the beds, once that beds aeolian exhibit consumed grains by the abrasion of the wind (mature), while facies of dissipation introduces the mixture of this kind of grain with fragmented grains (immature) came directly from the basement of the topographical obstacle (PAISANI, 2005). The litic rock fragments occurrence in certain beds of the deposit is seen as strong indication of the processes performance of the hillside environment. In general, it used conventions and informal codes of facies highlighting the deposit agents of sedimentary environments, instead of the usual constitution granulometric of the beds of a same environment. By the sedimentary characterization means of the column sections it individualized 19 beds that are divided into four lithofacies: tecnogenic, aeolian, of dissipation and beach, as well as 03 paleosols. In general the sand deposit established in front of topographical obstacle exhibits 07 aeolian beds and 05 dissipation beds, whose last are thinner. It does not remain doubt that it constitutes a *coastal sandy ramp*, however, it is not exclusively resultant of reworking of the sedimentation aeolian with thought these authors. The aeolian beds are in larger number and thicker than the ones of dissipation, they correspond the last sedimentation phase in the deposit.

Keywords: climbing dunes, sandy ramp, coaste south of Brazil.

INTRODUCTION

The sand accumulation in front of topographical obstacle generates two kinds of dunes: climbing dune and echo dune (PYE & TSOAR, 1990). While the first one is formed by sand accumulation in touch with the obstacle, the second one develops sand sliding face in front of the obstacle.

The climbing dunes have been being recognized in different sedimentary environments in the tempered and tropical regions (EVANS, 1962; PYE, 1993; SEPPÄLÄ, 1993). In tropical coastal and subtropical areas, some authors designate them *sandy ramp* (SHORT, 1988; ISLA & ESPINOSA, 1995). On the other hand, the sandy ramp term was

proposed for BIGARELLA (1974; 1975) to refer to the climbing dune discharacterized morphologic and structurally along the Quaternary in Santa Catarina Island, south of Brazil. For the author, the sandy ramp would be constituted mostly from the mixture of the aeolian sediments with hillside sediments. That phenomenon would be generated by rain processes (dissipation process) in extreme climatic terms, arid to semi-arid. This connotation bases on model morfhoclimatical proposed by Bigarella *et al.*(1965a) for the evolution of the fluvial/hillside system and, until then, used in the comprehension of the genesis of *colluvium ramps* (BIGARELLA et al., 1965b).

In desert environment the sandy ramp term has been being used to define deposits constituted of aeolian, fluvial, hillside facies and with paleosols, established in front of a topographical obstacle (LANCASTER & TCHAKERIAN, 1996; THOMAS et al., 1997). Such verification introduces relation to the founds of Bigarella (1974; 1975) in Santa Catarina' Island and it points that in fact there are significant differences between climbing dune and sandy ramp stratigraphic record.

Although it is the great worth the Bigarella's pioneering work (1974), the people has little knowledge about the occurrence of sandy ramps in Brazilian coast. In Santa Catarina Island there are divergencies regarding the definition of the sandy deposits found in front of topographical obstacle (BIGARELLA, 1974; HERMANN, 1989; MARTIN *et al.*, 1988; CRUZ, 1998; CARUSO JR & AWDZIEJ, 1993). The present article introduces the stratigraphy of the deposit found in front of topographical obstacle on Praia Mole, Santa Catarina Island – South of Brazil, defining if it corresponds to the climbing dune or sandy ramp, contributing for the differentiation between both.

STUDY AREA

Santa Catarina Island is located in South of Brazil in subtropical climatic zone (Figure 1). Praia Mole is in the east portion of the island, it exhibits about 1 km of extension (CASTILHO & GRÊ, 1997) and it characterizes for medium sand (GRÊ *et al.*, 1994). It limits in the east with Atlantic Ocean, west with Conceição Laggon, north with Galleta Massive and in south with Joaquina Massive (Figure 1).

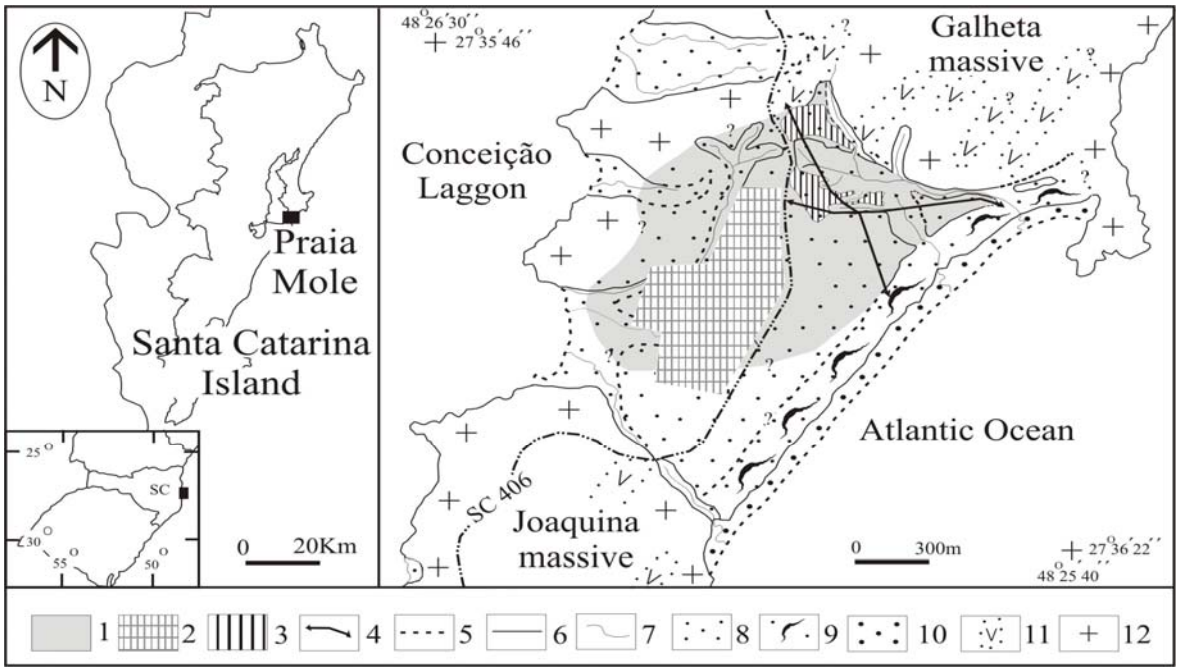

Figure 1 – Location and Geology of Praia Mole (PAISANI, 2004a). (1) studied deposit. (2) urbanized area. (3) landed place. (4) topographical profile, whose location is established by column stratigraphic sections. (5) soft contact. (6) abrupt contact. (7) drainage. (8) current beach. (9) antedune current. (10) indifferentiated sand – Superior Quaternary. (11) diabases dike – Mesozoic. (12) granite – Proterozoic /Eopalaeozoic.

The deposit extends by the largest part of place (Figure 1), which is divided by SC highway – 406 into two different zones from soil use: 1) urbanized, in the west band, and 2) in ways of environmental recovery, in the east band. The zone in recovery ways exhibits herbaceous and bush vegetation, regenerated after the agricultural using during the 1930 's and 1940 's. The north portion of this zone suffered partial transforming due to landed thing done in decade of 1980, occurring gullies development. If on one side the landing discharacterized part of the deposit original topography in this sector and promoted loss of the stratigraphic record, on the other hand it exposes stratigraphic sections in gullies. Such sections reveal levels of oxidized sand that was characterized and recognized as horizons B of paleosols.

METHODOLOGY

The definition if the deposit established in front of topographical obstacle on Praia Mole (Santa Catarina Island) corresponds to the climbing dune or sandy ramp, it based on establishment of the deposit stratigraphy.

The stratigraphic rising concentrated on the north sector of the beach in the location in which the deposit meets Galleta Massive. The stratigraphic sequence of the area was

defined correlating 14 column sections organized along 02 topographical profiles in the sense E-W and S-N (Figure 1). The sections were defined landed gullies and by means drilling's. The beds were identified indirectly by means of granulometrical diagraphy, whose procedures are detailed by Paisani (2004b). The use of this procedure for the thin fraction (clay and silte) enabled to define accurately the horizons limits B of paleosols. Morphologic descriptions, micromorphological, the total chemical composition and the counting of heavy minerals of the very fine sand fraction of these horizons revealed that it is autoctone paleosols generated from the alteration of heavy minerals (PAISANI, 2004a; c; d; submitted).

The beds with mixture sediments between aeolian and of hillside were designated dissipation facies'. The individualization of the aeolian facies and of dissipation facies was sent by the analysis of the superficial texture of the quartz grains of the beds, once that beds aeolian exhibit consumed grains by the abrasion of the wind (mature), while facies of dissipation introduces the mixture of this kind of grain with fragmented grains (immature) came directly from the basement of the topographical obstacle (PAISANI, 2005). The litic rock fragments occurrence in certain beds of the deposit is seen as strong indication of the processes performance of the hillside environment. In general, it used conventions and informal codes of facies highlighting the deposit agents of sedimentary environments, instead of the usual constitution granulometric of the beds of a same environment.

RESULTS AND DISCUSSIONS

By the sedimentary characterization means of the column sections it individualized 19 beds that are divided into four lithofacies: tecnogenic, aeolian, of dissipation and beach, as well as 03 paleosols (Figure 2).

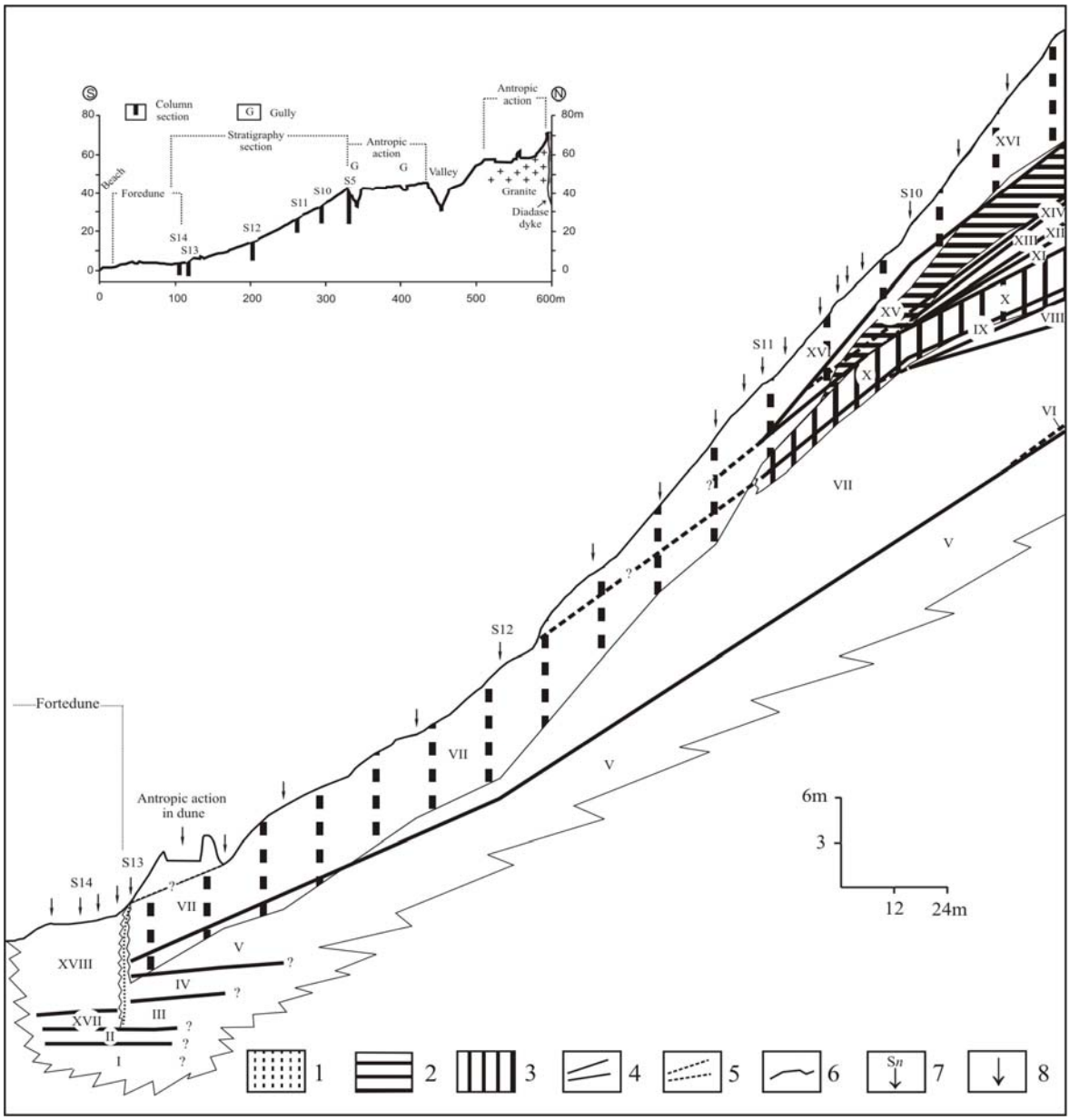

Figure 2 – Correlation lito' and pedostratographic in the private section profile S-N. (1) pedostratigraphic unit 3 – paleo-alfisol abrupt red-yellow. (2) pedostratigraphic unit 2 – paleo-alfisol abrupt red-yellow. (3) pedostratigraphic unit 1 – paleo-oxisol red-yellow. (4) beds/ units lithostratigraphic. (5) beds of infered extension. (6) topographical profile. (7) column section. (8) drilling (PAISANI, 2004a).

It recognized only the XIX bed as *tecnogenic very fine sand*, because it was generated during the landing of the sandy ramp in 1980's. The bed exhibits plane and convolute laminations, registering plastic in laminations the location already dismantled by the erosion.

It identified 08 aeolian beds (I, V, VI, VII, X, XIII, XV and XVI), being 05 *fine sand,* 02 *fine sand to fine/medium sand* and 01 *residual of deflation fine/medium sand*.

The beds VIII, IX, XI, XII and XIV were recognized *as dissipation fine sand to medium sand* (Figure 2), and the beds IX and XIV contain, respectively, granules line and

discontinuous stones lines. With its concepts, for lithofacies of dissipation it characterizes by the mixture between aeolian and hillside sediments (BIGARELLA, 1974; 1975), with grains as fragmented (immature) as consumed by the abrasion (mature). The thin pebble fraction is what generally introduces fragmented grains, for a lot of times constituting litic fragment of granite. The morphometry and superficial texture of the grains of the lithofacies beds of dissipation reveal that bigger fractions than thick sand to very thick exhibit dull grains in significant percentile, indicating the mixture between hillside and aeolian (PAISANI, 2004a; 2005). The smallest fractions have similar characteristics to those identified in the aeolian beds. In general, they register three tendencies: 1) immature grains in the thin pebble fraction; 2) mature grains in smaller fractions than coarse sand; and 3) zone of gradual mixture between both the categories, situated between coarse sand fractions and granules (PAISANI, 2004a; 2005).

In the inferior limit of the sandy ramp deposit it identified, with help of the morphoscopical analysis, three beach beds (II, III and IV) which exhibit significant granule variability and predominance of medium to fine sand (Figure 2). The beds II and IV classified as *beach medium sand* and the bed III defined as *beach medium to fine sand* (Figure 2).

In direction to the beach, the deposit passes sidelong to the antidune with soft topography (PAISANI, 2004a). The analysis of granulemetrical diagraphic and of the lateral extension of paleosols indicate that in subsurface lateral erosion of the sandy deposit due to the erosion caused by the sea transgression (PAISANI, 2004a). In the antidune individualized a bed *beach medium/coarse sand* and another *beach/aeolian medium fine to fine sand*, denominated, respectively of XVII beds and XVIII (Figure 2).

In general the sand deposit established in front of topographical obstacle exhibits 07 aeolian beds and 05 dissipation beds, whose last are thinner.

CONCLUSIONS

The stratigraphic rising of the sandy deposit established in front of topographical obstacle in Praia Mole, Santa Catarina Island, south of Brazil, exhibits paleosols and, above all, aeolian lithofacies and of dissipation. It does not remain doubt that it constitutes a *coastal sandy ramp* as suggested by Bigarella (1974; 1975) and Hermann (1989), however, it is not exclusively resultant of reworking of the sedimentation aeolian with

thought these authors. The aeolian beds are in larger number and thicker than the ones of dissipation, they correspond the last sedimentation phase in the deposit (XVI bed).

It verifies that the sandy ramp of the study area differentiates from the similar deposits found in desert environment, at first by the absence of fluvial lithofacies. Regarding to the sedimentation, the theoretical purpose that the aeolian sedimentation would be exclusive of interglacial periods, while the dissipation of glacial periods (BIGARELLA, 1974; 1975), does not show direct relation to the stratigraphic record of the study area, because it was verified aeolian beds in both periods. The meaning palaeoclimatic of the dissipation lithofacies is not so comprehended, it verifies only the coincidence of occurring in the last glacial.

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