

Geomorphological hazards on the flysch rocky coast of Liguria – Italy

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The coastline of Liguria is around 355 km in length. The study area is situated in the eastern coast, which is formed of 51% of rocky coast, 22% of beaches and 27% of artificial coast. We have examined the stretch of coast included between Chiavari and Rapallo (about 6 km) formed by a Cretaceous-Paleocene limestone clay flysch. The morphology is characterized by large cliffs, up to 150 m in height, where the beddings of strata and of many fractures towards the sea are not favourable to the stability of the coast. We have controlled that the regression of the rocky coast, revealed by rockfalls, rockslides, rocktopplings and slumping landslides, is increased by the waves erosion at the base of the cliff, often affecting the human settlements (residential, turistic, roads, railways), located along the coast. We have studied the conditions of stability through geomechanic analysis and frequency of landslide phenomena and represented in some samples by geomorphological maps, sections and photographs. We have compared the geomorphological hazards with vulnerability in order to define the level of environmental risks of this area.

Key words: flysch, rocky coast, geomorphological hazards, landslides, waves erosion, environmental risks

Typology of Dune Fields of the Ceará State, Northeast BrazilV. CLAUDINO-SALES*¹ and J.P. PEULVAST²¹ Department of Geography, Federal University of Ceará, Fortaleza, Brazil² Orsayterre, CNRS, University of Paris-Sud and University of Paris-Sorbonne, France

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In the Ceará State (northeastern Brazil), large coastal dune fields extend along the 573 km of coastline, penetrating landward up to 30 km. These systems of mobile and fixed dunes are arranged in well defined successions, well developed in places where wide coastal plains were created by Late Holocene regression or progradation. In those sections, the first forms identified are foredunes or sand sheets where, under the action of the SE trade winds, nebkas may develop into rebdous in places where vegetated or consolidated dunes are re-shaped. In other sections, they give place landward to blowouts and parabolic dunes, and then to transgressive hairpin or longitudinal dunes. In less vegetated areas, transverse dunes and, finally, waves of barchanoids or barchans extend inward from the coastal sand sheets or blowouts, until they are halted by river mouths or older vegetated dunes, or they spill in the sea on the lee-side of capes. Some of them are transgressive on former longitudinal dunes. Since this evolution depends on the deflation of old dune fields more than on sand input from the shore, several types and generations of dunes may be exposed in given areas, according to variations of coastal dynamics in space and time. Both the present and old dunefields have allowed the development of various types of dune lakes.

Key-words: dune field, coastal dunes, dune lakes and ponds, dune generations

**Volcanic Land Aggradation Versus Wave Differential Erosion:
Coastal Landforms of Galapagos**

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In Galapagos Islands effusive and explosive volcanism coexist, and a decreasing age from east to west is observed. This allows us to analyze two opposite processes: aggradation due to active volcanism and differential erosion due to wave action. Volcanic activity results in four types of coast, observed at various stages of erosion. Lobes of serrated coast of aa type lava (1). Irregular coast, with prominent rocky capes along tunnels of Pahoehoe lava flow (2). High but easily eroded coast of tuff cones and rings formed by volcanic explosive activity at the contact of seawater with land (3). Stair shaped coast and platforms, with emerging lines of rocks along the lava filled fractures (4). Wave effect includes trimming back and lining up of the old aa type flow lava, with karst dissolution patterns on the oldest late Pliocene flows. As the volcanic aggradation takes place, tuff cones are incorporated inside the island, providing a marker of land aggradation.

Key words: Galapagos, coastal morphology, volcanic geomorphology

Isolated Ripples in Barchan Shape Formed Under Oscillatory FlowN. ENDO^{1*}, H. KUBO¹ and T. SUNAMURA¹¹Department of Earth and Space Sciences, Osaka University

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Flume experiments using scarce very-fine sand under the action of oscillatory flow of 25 cm water depth showed that isolated ripples with the size of less than a few centimeters were formed; they were in very similar shape to barchans with a huge size commonly seen in deserts. It is generally thought that barchans or barchan-shaped bedforms are formed only by air or water flows with a dominant direction. Our experiments were performed under surface waves with wave periods of 1.5 – 3.0 s and heights of 6-9 cm. The most symmetrical flow among nine experimental runs had about only 6% difference in near-bottom velocity between onshore and offshore directions. Sand particles moved in both directions. All isolated, barchan-shaped ripples pointed their horns onshore. They were slightly different in morphology; for example, some were heart-shaped and others arrowhead-shaped. They had a wide variety of size in one experimental run. The volume of barchan-shaped ripples, however, was found to be proportional to the 3/2 power of the base area, irrespective of wave conditions. Their migration speed was proportional to the square of the maximum flow velocity near the bottom and inversely proportional to the root of ripple heights, independent of wave periods.

Key words: isolated ripples, barchan, oscillatory flow, migration speed

The Relationship Between the Rip Currents and the Drowning Incidents in the Coasts of ^a ile Between 1985 and 2000 (Black Sea, NW TURKEY)

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The main effect caused the forming of the coasts of Turkey is waves and currents and the second one is tides and livings also. The currents of these factors are collected in 3 groups as longshore current, deep current and rip current. The sea water reached to the coast with waves, searches a returning way to it. Meanwhile, some of them move a long shoreline by turning to sides. But, the most important part of the sea water accumulated at the coast ebbs from surface to the offshore with the waves are thrown to the forward by surfing. This type of currents that the ebbing mechanism is not according to the deep current. By it is established relationship with geomorphology of the coast of ^a ile and rip currents-drowning incidents, the conclusion and advices will be presented. The rip current especially at the mouth section of the rivers with small scale of the coast of Black Sea, on the shallow surfing zone progresses. The drowning incidents was seen by catching in rip currents between 1985 - 00 at the season of the recreational aimed sea tourism, natural sandy beaches at the edge of the shore establishments, in the beaches as the fisherman harbour, fisherman shelter, the place for fastening vessel, the lighthouse and the breakwater built by the man and on the section of the mouth of the river which are reached to the sea

Key words: Rip Currents, coast of Black Sea, life-sever organization

Costal Geomorphology and Environmental Zoning of Estuarine Areas - Brazil

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This work is an application of a methodological proposal for the elaboration of an environmental zoning of a estuarine area in Brazil. Such proposal is based on the choice that Geomorphology is a subject which provides theoretical, technical and empirical support. In the technical field, cartographic documents were elaborated (geologic, geomorphologic, use of the land and environmental zoning maps) by means of computers. The field works were also important for the understanding of the local reality and with the information obtained through remote sensors, they supplied data for the definition of the geomorphologic compartments that they are the physical bases for the definition of the zoning. As to the relationship to the environmental zoning, Clark's proposal (1974), was taken, defining the geo-genetics characteristics (Geology-Geomorphology), as the parameters for preservation, conservation and controlled use classes. Islands of Cananéia, Iguape and Ilha Comprida, were the study areas. They are Areas of Environmental Protection, where the human presence is still restricted, but the tourism has been causing an increase of the urbanization process. To seen up, the proposed zoning, aims being an instrument for the planning and administration of the environment of the cited places.

Key words: Coastal Geomorphology, Environmental Zoning, Estuary, Brazil.

Holocene Sea-level Change Around Sendai Bay, Northeastern Japan

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A Holocene sea-level curve was reconstructed based on over one hundred C-14 datings, which were collected from the alluvial lowlands facing Sendai Bay, Northeastern Japan. The curve indicates there are three phases of sea-level change, i.e., a rapid rise phase (10,000 to 8,500 yr BP), a comparatively stable phase (from 8,500 to 7,000 yr BP) and a phase with slight fluctuations (from 5,000 yr BP to present). The rate of sea level rise during the rapid rise phase was calculated to be 20 mm/yr, which caused rapid transgression on the alluvial lowlands (the Kitakami River Lowland and the Sendai Coastal Plain). The sea-level rose from 12 to 5 meters below the present sea level during the comparatively stable phase, and regression was commenced in most locations in these alluvial lowlands. In the phase with slight fluctuations, four peaks of sea-level were recognized from the study of the beach ridge ranges, i.e., in 4,500 yr BP, 3,500 yr BP, 2,000 yr BP and 1,000 yr BP, and three lower sea-levels were estimated from the study of buried shallow valleys, i.e., in 4,000 yr BP, 3,000 yr BP and 1,500 yr BP. In this report, the actual levels of higher peaks and lower sea-levels were not obtained, but the periods of sea-level rise and fall were shown clearly by the geomorphological situations. The range of fluctuations was considered to be within three meters above/below the present sea level.

Key Words: Holocene, sea-level change, Alluvial Lowland, C-14 datings, Sendai Bay

**Influence of Large-Scale Turbulence by Spilling Breakers on Excavation of
Bottom Sediment**

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In the surf zone of spilling breakers there are two kinds of large-scale turbulence. One is named a “downburst” which is a descending turbulent water mass without marked rotational features and the other is called an “oblique vortex” which has the axis of rotation being leaned shoreward and develops obliquely extending its length toward the bottom as a bore propagates. With the purpose of scrutinizing the influence of the two kinds of turbulence on the excavation of bottom sediment, wave-flume experiments were conducted. Wave periods ranged from 0.8 to 1.2 sec and breaker heights from 4 to 12 cm, and nine cases were performed. The volume of sediment particles removed when the turbulence acts on the bottom was measured from the images of a high-speed video camera. It was revealed that (1) the mass of sand grains removed by the downburst is larger than that by the oblique vortex under the same wave condition and increases with increasing breaker height; and (2) the downburst is of vital importance when the sediment removal in the surf zone by spilling breakers is considered.

Key words: large-scale turbulence, spilling breaker, excavation of sediment, downburst, oblique vortex

**The Relationship between Width of Reef Flats and Gradient of Reef Slopes,
Ryukyu Islands, Japan**

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Aerial photographs and the 1:50,000 sea charts were used to study the relationship between width of coral reef flats and gradient of coral reef slopes in Ryukyu Islands (from 24. to 30. N latitude), southwest Japan. The maximum widths of reef flats were found to be decline in a liner fashion of latitude from Yaeyama in the southwest to Tane Island in the northwest. Many reefs have low-angle slopes (less than 10°), and the steep reef slopes like equatorial atolls were very rare. These results indicate that coral reefs in Ryukyu Islands have the strong wind and catastrophic wave energy conditions of the subtropical high pressure belts relative to the equatorial pressure belts.

Keywords: Coral reefs, Daly Point, reef flat, reef slope, fringing reef, Ryukyu Islands

Laboratory Experiments on Deformation of Wave-Formed Ripple MarksT. SEKIGUCHI^{1*} and T. SUNAMURA¹¹Department of Earth and Space Sciences, Osaka University

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This study focuses on the deformation of ripple morphologies by waned waves, and discusses the deformation process. A series of wave-flume experiments were carried out under various combination of the original ripple geometry, wave conditions and sediment grain size. Well-sorted quartz sands were used as the bottom sediment. The original ripple wavelength ranged from 4 to 20 cm, wave period from 1.0 to 3.0 sec, wave height from 2 to 13 cm, and grain size from 0.2 to 0.6 mm. For each wave period, wave height was determined so that wave orbital diameter did not exceed that of waves that formed the original ripples. The results showed that the original ripples were (1) superimposed by secondary crests, (2) modified into ripples with a rounded crest and an angular trough, and (3) not deformed markedly. It was found that (1) secondary crests appeared under the action of symmetrical waves irrespective of sediment grain size, (2) the round-crested ripples formed when asymmetrical waves act on the original ripples with coarser sediment, (3) no significant deformation occurred when they act on the ripples with finer sediment.

Key words: wave-formed ripple marks, secondary crests, rounded crests, deformation process

**Beach Changes Caused by Elongation of Harbor Breakwater in a Pocket
Beach and its Mechanism**

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Pocket beach has a closed littoral system and, therefore, construction of harbor breakwater near the corner of a pocket beach causes overall topographic changes in the pocket beach. The shoreline advances in the lee side of the harbor breakwater, whereas it recedes in the rest of the pocket beach. This study investigates this mechanism by taking the Tsutsuki Beach in Iki Island as the example. This beach has a longshore stretch of around 800 m and is composed of fine sand. Since 1966, harbor breakwater has been extended at the northeast end of the pocket beach. At the first stage, the tip of the breakwater was located in the lee side of the headland. As the breakwater was further extended, it protruded in the sea, forming wide calm wave zone. The shoreline changes were analyzed based on the comparison of aerial photographs and its mechanism was elucidated by Hsu's model for stable beach.

Key words :pocket beach, shoreline change, harbor breakwater

**Geomorphic Controls of Sedimentation in Fresh-Water Tidal Wetlands,
Mattaponi River, Virginia, U.S.A.**

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The geomorphic model for this fresh-water tidal river relies on interpretations of sediments sampled by vibracore in five marshes. Large wetlands coated with mucky silt or clay form in meander bends. Most meanders of the present tidal river erode the low-sinuosity valley walls formed by Late Pleistocene streams. Across the study area, meander bends change from fluvial- to tide-dominated. Some wetlands formed as the channel migrated and incised. Others accreted vertically, particularly at sites downstream of obdurate cliffs that influence the thalweg at high flows. Proximity to the main channel controls only minor variations in marsh sedimentation at most sites, usually recognized as either a slight coarsening of the fine fraction or an increase in clastic sediment. Significant sedimentation from high fluvial flows is recognized only in the upper reaches of the fresh-water tidal zone. Geomorphic data and radiocarbon dates indicate that most channel meanders migrated to approximately their present locations relatively quickly during the Late Pleistocene or early Holocene, but maintained their positions during Holocene sea level rise.

Keywords: wetlands, fresh-water tidal, sedimentation, Holocene, sea level rise

**The Relationship between the Morphology of Combined-Flow Ripples and
Flow Characteristics**

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The relationship between the morphology of two types of combined-flow ripples and the characteristics of combined flows was investigated. Combined-flow ripples have round, and either symmetric or asymmetric profiles. Roundness of the ripples was expressed here by the curvature profiling software, and it was found that curvature distributions along the ripple profiles are different between the ripples by favorable and adverse currents. As the relative magnitude of unidirectional velocity became higher, the profiles of ripples by favorable currents became more asymmetric, while ripples by adverse currents kept symmetric profiles. The loci of water particle motion both by theory and experiment are in good agreement, and are different between the two kinds of combined flows. The ripple profiles depend on (1) the behavior of sand movement affected by the horizontal acceleration of water particle motion, and (2) the size of vortices in troughs which is influenced by vertical velocity of combined-flows.

Key words: combined-flow ripples, ripple morphology, water-particle motion, flume experiment, sand movement

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Barriers and beaches of the Cabo Verde Archipelago develop in coastal sections of different exposures. The barrier situated in the Sao Pedro Bay on Sao Vicente Island has a southern exposure and its development is influenced by:

- tides reaching here up to 2 metres,
- wind waving, waves coming from south, from inner archipelago basin,
- trade winds blowing from the northeast, that is from the island. They reach maximum velocity in January-February, minimum – from June to August.

The barrier is built by volcanic sands originating from abrasion of the Mesozoic and Tertiary volcanites and by quartz sands flown over by trades from the opposite edge of the island. The structural features of the barrier and of its ocean-side vicinity reflect the great energy of the processes that shape the barrier.

Key words: barrier, island, wave action, tide, NE trades.

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