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Comparison between different approaches in granulometric analysis applied to Roccella Jonica longshore sediments (South Calabria)

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The characterization of sediments by always is a variable and controversial argument especially in the context of the study of the coasts and in the light of the various directives issued in Italy from various "AUTORITÀ DI BACINO REGIONALE" (ABR). This work wants to explore different methods of study proposed in the literature with an eye to those requested by the ABR Calabria. To do this you will take as an example the data of granulometric curves of the samples taken from Dr. Geol. Iacopino inherent the geologycal e sedimentologycal study of "*Il ripascimento dell'arenile del comune di Roccella Jonica con l'utilizzo del materiale ad est del porto. APQ Regione Calabria, Delibera C.I.P.E. 35/2005.*" The study has provided the levies of 88 samples along 16 transepts of marine sediments of which 30 onto the beach and 58 on the seabed, in order to define the tessitural characteristic of different granulometric populations of sediment, by granulometric and applied sedimentological, dynamic and modal analysis.

The beach of Roccella Jonica (RC) is located along the southern section of the Calabrian Ionic coast and is classified as a coastal alluvial fan plain interested by a general crustal uplift and simultaneous subsidence during all Quaternary period (FERRETTI *et alii*, 2003).

The coastline of Roccella Jonica (PISCIUNERI *et alii* 2008) is straight, and extends for about 8.5 km in the direction about SSW-NNE (coastal water of amplitude 180° between directions 60 ° -240° N), with a variable width from 10 to 100 m.

In the area, systems of NE-SO faults affect the physical geography, because it detects, concordant with the main tectonic, net alignments of peaks and saddles, embankments rectilinear and watercourses to linear development and perpendicular to the coast. The hydrographic network consists of numerous "fiumare" by short and straight course , whose basins have limited areal extent.

Because of their torrential regime, they occur periodic floods with an important solid transport to the sea, that also happens in the form of suspended load underlined by the wide turbid plumes, at times, some kilometers toward the breadth. The beach toward the inside, in the not anthopic area, is delimited, to from coastal dune cordons, lying parallel to the coastline.

The composition of the coastal sediments reflects that of river sediment of fiumare Amusa, Allaro and Precariti (IBBEKEN & SCHLEYER, 1991). The pebbles are constituted by granitic rocks, metamorphic rocks of low grade and sedimentary rokcs, form by siliclastic sediment and limestone, and reflect a provenience from the unit of "*Stilo*" terrain, which to rappresent the main tectonic units in this area. According to IBBEKEN & SCHLEYER (1991)the coastal portion of Roccella Jonica falls in the fluvio-coastal province from the "*Massiccio delle Serre*".

The seabed in the area in front of the coast of Roccella Jonica is characterized by a narrow continental shelf, the average width of 4 km, with the slopes of the order of 1° whose margin with the escarpment placed to an average depth of 120 m. It is delimited both north and south by deep canyons active affecting both the platform and the escarpment.

From the analysis of the marine climate was determined the wave climate of the coast considered, which has for the waves low (0.5 -2 m), medium (2-4m) and high (>4 m) respective directions 60-110° N, 110-160° N, 120-140° N. The currents are in direction NE-SW with drift sediments in this direction.

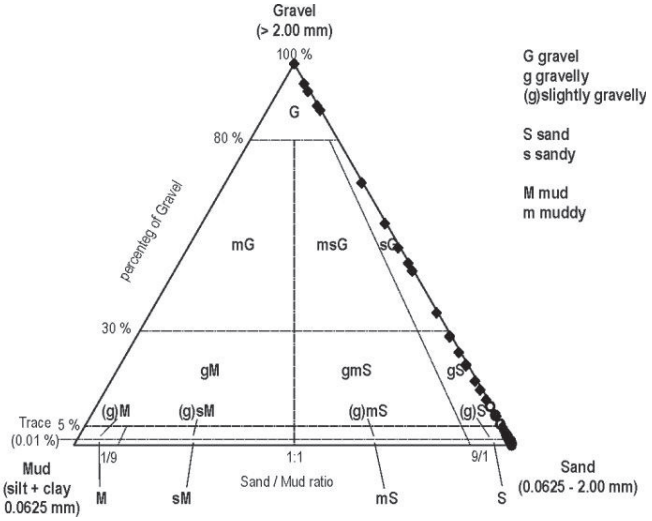

Fig. 1 – Classification on ternary diagrams of the samples taken.

The 88 samples were analyzed by sieving, by choosing an appropriate number of sieves that it cannot be too small for the analysis of probabilistic scale but also not to be too much for not

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flatten excessively the curve of frequency distribution.

The different granulometric curves proposals were represented on the granulometric scale by UDDEN (1914) and WENTWORTH (1922) and subsequently amended by BLAIR & MCPHERSON (1999) through the use of the phi-scale ladder as defined by KRUMBEIN (1938).

The samples (fig. 1) were classified using the triangular diagram of FOLK ((1954).

From analysis of the triangular diagram the samples of emerged beach are composed of sand, sand gravelly and sand slightly gravelly, while the seabed sediment cover a broad classifying spectrum going from gravel to sand.

The different granulometric curves were parameterized through all the different statistical parameters for both via graphics, as proposed by FOLK & WARD (1957), and by the determination of the moments (FRIEDMAN, 1962). It was performed a comparison between the two methodologies which shows how there is a good correspondence between mean and standard deviation calculated by the two methods, but that the same is not found for skewness and kurtois. It has therefore chosen to use the data obtained for graphics method (fig. 2).

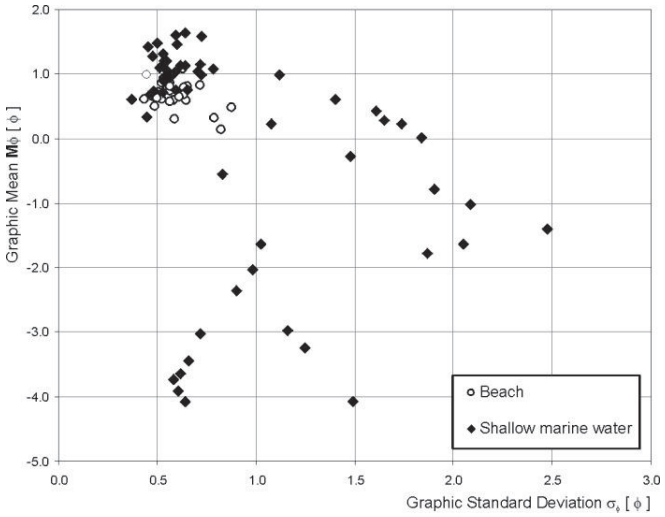

Fig. 2 – Comparison between the average and the standard deviation of the samples.

On the samples were carried out three different analyses: PASSEGA (1957, 1964 e 1977), VISHER (1969) and RIVIERE (1977).

PASSEGA (1957) plot the values of the 1° percentile as a function of the 50° percentile (median) by identifying different populations moving with different dynamics: particles that move by rolling on the bottom, gradated suspended and uniform suspension.

VISHER (1969) and RIVIERE (1977) analyze the particle size distribution curve in function of they "normality". The first identifies several tracts "normal" in which break down the curve to which they are linked different systems of transportation of the material.

RIVIERE (1977) based his analysis on the principle that the granulometric curves may not have a "normal" trend and that all can be traced back to a feature fictitious particle size dependented on the index of evolution granulometric N.

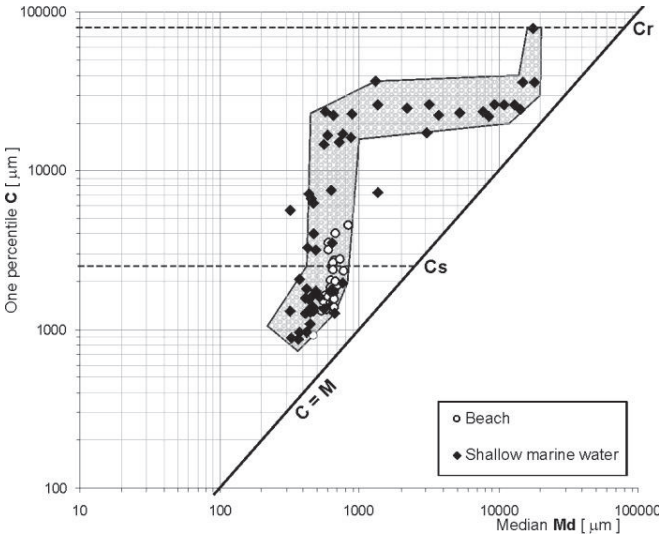

Fig. 2 – Diagram of Passega showing the evolution of the one percentile in function of the median.

From the analysis of the diagram of PASSEGA (1957) (fig. 3) it is possible to notice the presence of a population of "gradated suspension" composed of sand ,the maximum dimension of which is marked by the value Cs of the graph (about 2.5 mm): in this group there are part of the sediments of emerged beach and part of the sediments of the seabed. The remaining sediments are found on top of this group and are characterized by different types of transportation ranging from "gradated suspension" to rolling on the bottom (characterized by a maximum size Cr equal to about 7.0 cm).

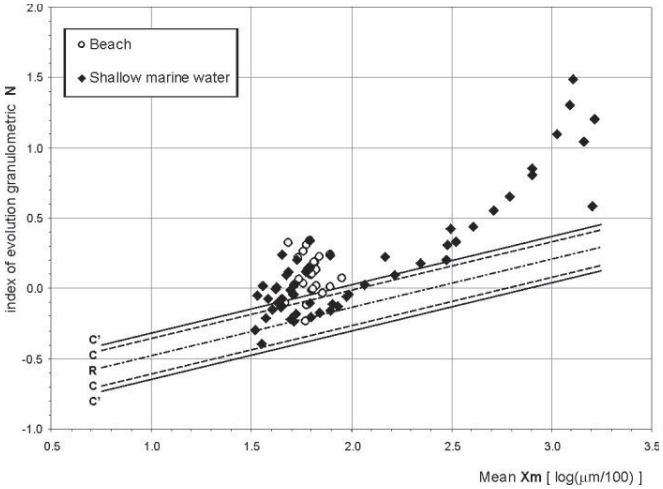

Fig. 4 – Diagram of Riviere showing the trend of the index of granulometric evolution N as a function of the average Xm

This characteristic is found from the analysis proposed by VISHER (1969), from which one can note a strong presence of the "population of saltation" (equivalent to "gradated suspension" of PASSEGA) with code variables of populations of "traction" and "suspension".

Finally, for each sample was determined the index of granulometric evolution N and the coarseness Xm as defined by RIVIERE (1977) in the "new model". In particular N was determined by setting to zero the function U derived from the feature fictitious particle size, and determining for subsequent iterations which value of N better satisfies the equation.

Were then plotted (fig. 4) the values of the index of granulometric evolution N as a function of the average Xm.

From the analysis carried out it may be noted the presence of both normal particle size in hyperbolic facies, corresponding to the terms "fixed suspension", an anomalous particle sizes in ultraparabolic facise.

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