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THE POST-TYRRHENIAN EVOLUTION IN SARDINIA: EVIDENCE FROM EBIDOZZI PALAEOVALLEY (ARGENTIERA, NORTH-WESTERN SARDINIA, ITALY)

ABSTRACT: GINESU S., DERUDAS A., ENZO S., SECCHI F. & SIAS S., *The post-Tyrrhenian evolution in Sardinia: evidence from Ebidozzi palaeovalley (Argentiera, north-western Sardinia, Italy).* (IT ISSN 0391-9838, 2009).

Analyses of selected samples coming from a well exposed plio-pleistocenic stratigraphic section located along the coastline of northwestern Sardinia, allow us to evaluate the recent geomorphological evolution of a sector belonging to an ancient valley infilled by sedimentary deposits, mainly of continental environment. The palaeovalley filling has been favored by erosional processes in post-Tyrrhenian regression times under climate exchange recorded during Holocene. The occurrence of halite mineral phase in the studied stratigraphic sequence, suggests the prolonged occurrence of salt environments during the early phase of post-Tyrrhenian regression before the begin of an aeolian regime. Assuming a uniform erosive process for the last 80 Ka, we evaluate its the efficiency on the basis of the volume of deposits infilling the investigated palaeovalley. The obtained deposition rate is about 0.5 m^3/year.

KEY WORDS: Coast evolution, Aeolian deposits, Tyrrhenian-Holocene, Sardinia, Italy.

RIASSUNTO: GINESU S., DERUDAS A., ENZO S., SECCHI F. & SIAS S., *L'evoluzione geomorfologica post-Tirreniana in Sardegna: evidenze dalla paleovalle di Ebidozzi (Argentiera, Sardegna nord-occidentale).* (IT ISSN 0391-9838, 2009).

Il rilevamento di dettaglio di una sezione stratigrafica localizzata lungo la costa nord-occidentale della Sardegna, opportunamente corredato da analisi minero-petrografiche di campioni rappresentativi, ha permesso di valutare l'evoluzione geomorfologica recente di un'antica paleovalle colmata da una succesione dominata da depositi di ambiente continentale.. Il riempimento della paleovalle è favorito da processi erosionali riferibili a cambi climatici concomitanti con la regressione post-Tirreniana.

La presenza di halite fra le fasi minerali osservate in alcuni campioni della sezione stratigrafica investigata, suggerisce la persistenza di ambienti a forte salinità riferibili ad una fase precoce della regressione prima dell'instaurarsi di un regime dominato da processi eolici. Assumendo che i processi erosivi siano stati piuttosto uniformi negli ultimo 80 Ka, la sezione stratigrafica investigata permette di valutare la persitenza dell'erosione sulla base del volume di depositi che hanno colmato la paleovalle di Ebidolzi. La velocità di colmamento così ottenuta si attesta attorno a 0.5 m^3/anno.

TERMINI CHIAVE: Evoluzione della costa, Depositi eolici, Tirreniano, Olocene, Sardegna.

INTRODUCTION

The investigated area is located along the western coastline of the Nurra region (northwestern Sardinia, Italy), from the Porto Palmas bay (*Pischina Salidda*) to *Punta de lu Pisanu* (fig.1). From a morphological point of view this region shows a relief not exceeding 240 m in height, with regular slopes to the sea. The hydrographic network is made by creeks because of the distribution of the main watershed line near to the coastline. Significantly, one can observe the different trend of river system among the internal sea slopes, suggesting the existence of palaeo-morphologies. On account of different geological and morphological characters, in the Nurra region we distinguish the Argentiera zone that represents the northern part and takes the name from the mining district of Argentiera, now abandoned. At the present time, this region is characterized by very low density of population reaching the higher incidence by tourist presence in the summer season. The territory is exploited by a limited sour-pastoral activity.

Published papers are mainly devoted to the Palaeozoic basement or to the Mesozoic covers that constitute the main geological features of the region. Despite of their considerable thickness and extension, little information is available on Plio-Pleistocene covers. The occurrence of a

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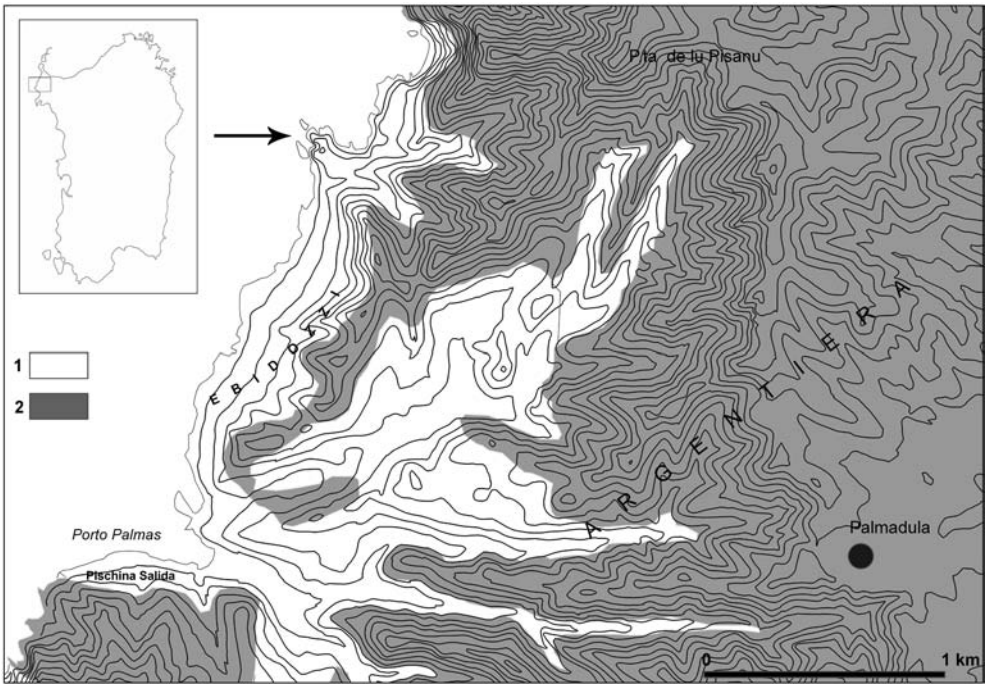

FIG. 1 - Localization of investigated area in geological sketch map. 1: Plio-Pleistocenic aeolian covers. 2: Palaeozoic basement; black arrow refers to the localization of sampled stratigraphic section. Equidistance of contour lines, 10 m.

well exposed stratigraphic section located near to Porto Palmas and reaching 10 m in thickness, offers the possibility to investigate the relationships among the different terms of the recent stratigraphical succession and to hypothesize the filling processes of the palaeo-valleys in post-Tyrrhenian times.

GEOLOGICAL FEATURES

The Nurra region is schematically characterized by the Palaeozoic basement and, subordinately, by wide and discontinuous Mesozoic covers diffusedly outcropping in the southern part. The Palaeozoic basement outcrops in the whole north-western sector of the Nurra between Porto Ferro and Capo Falcone cape, of the Argentiera sub-region. The Palaeozoic basement is arranged into a succession of alloctonous tectonic units, showing an increase of metamorphic degree from south to north and mainly represented by phyllites and quartzites to paragneiss in the northernmost portion of the region (Carmignani & *alii*, 1979).

The mesozoic covers outcrop outside the chosen area and are mainly represented by limestones and dolomias of Giurassic to Cretaceous age. These covers constitute the central part of the hydrographic basins of watercourses that drain toward east and whose watershed is closed toward the investigated area. Mesozoic covers show a hilly landscape dominated by soft forms and are characterized by the typical karst landscape, without a water drainage surface. The reliefs show a strong acclivity in correspondence of NS and EW trending faults (Ginesu & *alii*, 1994). Oligo-Miocene covers are represented by sporadically levels of conglomerates of fluvial lacustrine environment and related to the Scala Erre Formation of late Miocenic age, outcrop diffusely in the northern part of the Nurra region (Ginesu & *alii*, 1994).

The recent covers are mainly represented by deposits of aeolian origin and locally from talus and colluviums. The aeolian deposits are generally constituted by sandstones outcropping between Porto Palmas and the Argentiera mine area. In literature, sandly deposits of aeolian origin, located at about 30-40m of altitude, have been commonly referred to post-Tyrrhenian times (Fierro & Ozer, 1974; Ulzega & Hearty, 1986; Federici & *alii*, 1987). Aeolian deposits can be observed in proximity of the Porto Palmas beach, and document the overlap of different dune generation. Remarkably, these sandstones reach 30m of altitude and extend for more the 2 Km in the hinterland.

In the investigated succession, above fossiliferous deposits of paleo-beach environment referable to the Tyrrhenian age (fig. 2; Ulzega & Hearty, 1986), sands of aeolian origin interbedded to colluvium are locally observed. Moreover, this stratigraphic section documents several depositional phases in the würmian-holocenic time span.

The recent covers are also represented by several generations of colluvium which may be different in age and textural characters. The most ancient slope deposits outcrop to north of Porto Palmas, related to phases of deposition at the base of the slant. These deposits lie over a palaeosoil developed on aeolian sandstones linked to the first regressive würmian phase. They are constituted by sharp edged fragments of various size, coarse-grained sands of aeolian origin and phyllites fragments reaching about 20 cm in size. In addition, these covers show a wide diffusion and refer to a pre-lower Pleistocene age (Ginesu, 1989; Ginesu & *alii*, 1994).

FIG. 2 - Tyrrhenian beach-rock onlap on Palaeozoic basement locally observed along the coastline (Ebidozzi).

The recent and actual slope deposits are commonly observed along the coastline to north of Porto Palmas, above the post-Tyrrhenian aeolian sandstones.

The recentmost deposits, referable to the Holocene, cover the pediments with thin thickness. These covers likely linked to the recent evolution of the territory, are constituted by quartz pebbles of various size, dispersed in a sandy-silty matrix, partly derived by the reworking of more ancient deposits under the action of the diffuse rill (Bollettinari & Scanu, 1984).

From a tectonic point of view the Nurra region represents essentially a tilted block related to the Miocene tectonics and redefined during Plio-Pleistocenic times (Lecca & *alii*, 1997). Fluvio lacustrine deposits referable to the Pliocene, can be the result of recent tectonic movements. These deposits lying over Miocene marine sediments are constituted by quartz elements in a sandy-clayey reddish matrix (Cherchi & *alii*, 1979).

The aerial photo interpretation techniques suggest the existence of numerous tectonic features, sometimes of difficult chronological interpretation. NS, EW, ENE-WSW trending faults were redefined during post-Miocene times and conditioned the NS trending coastline forms. The recent tectonics of the Nurra region are characterized by a general uplift in post-Miocene times, that produced a general tilting linked to the activation of the western faults (Cherchi & *alii*, 1979). Local marine terraces commonly observed near to the coastline of the region, are linked to the interglacial periods and are distributed at different altitude, suggesting that the uplift continues to the Pleistocene.

MORPHOLOGICAL OUTLINES

Despite of the reduced extension of the investigated area, a certain diffusion of forms especially related to the coastal processes and influenced by different characters of outcropping rock–types are observed. Coast features and the occurrence of different generations of aeolian deposits, determined different morphologies described as it follows.

Structural forms

The structural forms of chosen area are influenced by faults, fractures and lithological contacts. Remarkably, the occurrence of asymmetric «V» shaped valleys and the emergency of well exposed quartzite dikes is observed.

Coastal forms

The coastline of the studied area is dominated by cliffs NNE-SSW trending, influenced by tectonic features of middle to post-Miocene age described above.

The erosive activity of the sea diffusedly favors collapse processes along the cliff and the subsequent fast withdrawal of the coast. A particular feature of the coastal line observable between Pischina Salidda to the Ebidozzi area, is the occurrence of a sea abrasion surface that testifies the withdrawal of the coast during the versilian transgression. The collapse deposits can be reworked to form a dead cliff coastline. The base of abrasion surface of Tyrrhenian age is observed locally and is exhumed by the removal of the aeolian and palaeo beach deposits.

The present-time notch and the activity of the turbulence motion of the sea waters are well visible in the first meters of the base of abrasion, testified by the presence of vasques observed on the sandly surface. The carbonatic composition of sandstones cement, favors a homogeneous behavior under erosional conditions. Insofar, the waves activity zone on these rocks is represented in the basal part by vasques and fossils (Tyrrhenian) that sometimes degrade toward wells and swimming pools of relatively large size (about 1m). In the highest side, generally located above 3-4 m, where the effect of the sea spray favors the origin of *lapiez* forms, the shore appears particularly uneven. Furthermore, a zone dominated by the diffuse rill effects the formation of pyramids of earth, whose top can be protected from a *calcrete* level or by the accumulation of quartz pebbles.

Among the partially exhumed forms it is observed the Porto Palmas ria. The progressive erosion of the aeolian deposits of the palaeovalley has exhumed the ancient part the original Tyrrhenian ria. The flat floor constituted by sandy deposits related to the regressive phase of the Porto Palmas river confirms the prolonged inactivity.

Slope forms

The investigated area is characterized by relief slopes incised by «V» shaped small valleys originated in a humid palaeoclimate (Bollettinari & Scanu, 1984; Ginesu, 1989). The hydrographic system is represented by small channels active only in the rainy seasons.

The pre- and post-Tyrrhenian sandy aeolian deposits form wide fossil dune fields that accumulated especially along the main bays. These deposits occur at relatively

high altitude and are observable from coastline until several kilometers of the hinterland. They constitute the slope covers which are particularly abundant on more consolidate sand deposits. as near Porto Palmas bay and in Palmadula area (fig. 3).

A form commonly observed along the slopes in the coastline, is represented by landslides actived by the withdrawal of the coastline that produces the deposition at the bottom of the cliff. Here, for a certain time period, small beaches were created. A recent example of these movements is offered by the beach near Punta de Lu Pisanu, dominated by black phyllites fragments coming from the landslide body.

THE EVOLUTION OF THE INVESTIGATED AREA

The main features of the observed landscape are produced during Tertiary tectonic phases; best examples of these palaeo-forms are preserved in the inner zones of investigated areas. Particularly, extensional tectonic phases related to the up mentioned Pliocene uplift, produced the tilting of Nurra block. This in turn produced a northward drainage of hydrographic network condemning the western portion to a more rapid demolition by the action of the sea erosion as well as by the increased energy of the relief. Consequences of these extensional movements are more evident in the northeastern part of the Nurra region, active by the faults that have determined the Oligo-Miocene though between Alghero and Porto Torres (Lecca & *alii*, 1997).

The differential uplift produced distinct hydrographic basins, separated by a watershed located not far to the coastline that, in the Argentiera zone, is mainly represented by cliffs. The watershed limited a coastal side toward west, characterized by small basins and creeks that run by the slopes directly to the sea. On the contrary, wide areas draining to the Golfo dell'Asinara gulf occur eastward of the main watershed line. As a consequence, this tectonic context modules low and high erosional rates in the eastern and western portion of the region respectively. This scenario, is in good agreement with the occurrence of movements of landslide and withdrawal of coastline because of the relatively high instability of slopes. As a consequence, the palaeo landscape features related to late Miocene, still well preserved in the reliefs of the eastern portion and in the diffused alluvial deposits, is progressively redefined by the withdraw toward east of the up mentioned watershed line, reducing the surface of this palaeolandscape.

In the eastern basin the tectonic phases are related to the upper Miocene and are characterized by collapse followed by a general tectonic uplift of the region during Pliocene times. The particular basin shape is due to this structural characteristic (Ginesu & *alii*, 1994). Nevertheless, the aspect of this region is decidedly influenced by the lithologies that produced three main geomorphological zones.

The climatic conditions has determined the presence of mature morphologies as inselberg and wide pediments mainly observed above all on the Mesozoic covers. These forms are produced during the Pliocene and the Pleistocene, especially along the coastal zone (Ozer, 1976; Ginesu & *alii*, 1994).

The western basin occurring on the metamorphic basement is characterized by low permeability that favors the diffuse and channeled rill producing a continuous withdrawal of the slopes and a rejuvenation of the territory. Except for the southern portion, the eastern basin is mainly represented by sedimentary rocks characterized by high permeability that reduce the surface circulation. The conditions of tectonic stability determined a palaeolandscape interested by the erosion of the recent deposits. The different characters of the two hydrographic basins, favors a continuous landscape redefinition moduled by the expansion at the expenses of the eastern basin.

Wide portions of Nurra palaeolandscape has been progressively destroyed by erosion of the eastern basins.

FIG. 3 - Recent aeolian covers onlap on metamorphic rocks of Palaeozoic basement near Ebidozzi site. Note the occurrence of an erosional surface at the top of aeolian deposits.

THE EBIDOZZI PALAEOVALLEY

The coastline near to Porto Palmas beach belongs to a territory in fast evolution as testified by forms and deposits related to active erosional processes. All the deposits related to continental environments are related to Pleistocene and are mainly represented by aeolian sediments or silty sandly products derived by their reworking. Subordinately slope deposits are observed interbedded to the aeolian levels.

In the piedmont areas, it can be observed the accumulation pediments, characterized by clastic coarse-grained fraction, locally with sharp edged elements, whose deposition can probably be attributed to the action of the diffused rill under cold-damp climate conditions likely referable to the arid phases of Pleistocene (Ozer, 1976). Almost of aeolian deposits observed along the whole coastline are attributable to the last cold climates (upper Pleistocene), that favor the production of wide aeolian covers up to the top of the reliefs (100-130m). Such deposits are generally

interbedded with *calcrete* horizons also covering the top of the sands observed along the coastline of Sardinia and interpreted as surfaces of link between the slopes and the line of beach in würmian times (Federici & *alii*, 1987).

In Ebidozzi zone, located not far from Porto Palmas beach, a promontory is observed does not exceeding the 30 m above the present sea level, with a pronounced cliff on metamorphic rocks.

In this zone is observed a sedimentary sequence testifying the infilling of a pre-existing palaeo-valley (fig. 4). The pre-existing palaeo-incision assumes a characteristic «V» shaped form showing quite open slopes with a succession of sediments characterized by varying colorations from light to dark colors (2.5YR-10YR of Munsell® chromatic scale) that underline episodes of pedogenesis and environmental variability. In addition, two cones of deposit are observable, at the northern edge in the central part the valley that hides almost of the exposed wall. The investigated sequence reaches the thickness of 10m to which should be added 2 more m from the base of the wall constituted by the surface of Tyrrhenian erosion and beach deposit.

The Tyrrhenian erosional platform, is well exposed in this coastal sector; it marks the contact with metamorphic rocks at about 1.5 m of altitude above the present sea level. A sedimentary level referable to the Tyrrhenian (Ozer, 1976; Belluomini & *alii*, 1986; Ulzega & Hearty, 1986) separates the Palaeozoic basement from the up mentioned sequence which is made up mainly by aeolian deposits mixed with the deposits coming from the slopes. The particular condition of the paleovalley located near to the watershed line, therefore near to the apex of basin, suggests the occurrence of a brief water course of small proportions. Reddish colored silty sandly deposits containing pebbles of various size chaotically distributed are observed up to the Tyrrhenian horizon. The contact between these deposits and the fossiliferous horizon is characterized by a silty-clayey level, of light brown color (7.5 YRs 5/2 of the Munsell® chromatic table), constituted by fine-grained sands with sporadic presence of granules of millimetric size. This level, observable at about 4m above sea level, grades upward to sediments of a typical aeolian environment.

The sequence is characterized by about 6 m of clayey sediments of aeolian environment enriched by less mature coarse-grained elements dominated by quartz and phyllitic rocks coming from the slope. On the northern edge of the palaeovalley, above the up mentioned northwestern deposit, it is observed the contact with the metamorphic rocks. The contact follows the inclination of the palaeoslope. Distribution, frequency and maturity characters of the fragments increase near to the contact with the palaeoslope in agreement with a possible origin of the observed deposits from the erosion of Palaeozoic basement. Locally the sequence shows the occurrence of centimetric lens, enriched in sharp edged fragments, that document the occurrence of running waters from the slope on the surface of the aeolian sands. Such levels show different colors ranging from 2.5 YRs 4/8 to 7.5 YRs 5/2 of the Munsell® scale and suggesting the existence of pedogenetic processes.

The top of the investigated sequence is dominated by aeolian fine-grained levels referable to two separate depositional phases, distinguishable on the ground of the different colorations: yellow-brown (10YR 7/3 and 8/3 of the Munsell®) scale) and grey (2.5 Y 8 of the same table). In addition, typical forms of aeolian deposits are observed as pseudomorphs of roots, *calcretes*, pseudo-*tafoni* and cross structures.

At the top of the sequence joined with the slopes, one can also observe quartz fragments to edges alive related to rill processes that characterized the whole infilling of the palaeo-incision during the less aride phases.

ANALYTICAL RESULTS

In the stratigraphic reconstruction of the Ebidozzi investigated sequence, the fossiliferous horizon has been considered as *marker* related to the Tyrrhenian times on account of 4 m of altitude above the sea level, commonly observed in Sardinia and chronological data obtained by racemization of aminoacids (Belluomini & *alii*, 1986; Ulzega & Hearty, 1986). After these brief interglacial periods, testified by the up mentioned transgressive deposits, the intensification of the cold periods recorded at maximum of last glacial period, determined the regression of the sea level to more than 100 m with respect to the present time. The textural characters of deposits located between Tyrrhenian sediments and aeolian sand at the top, suggest continental processes with local pedogenesis and deposed in several episodes as a consequence of climatic fluctuations of a same glacial period.

Petrographic and diffractometric analyses were carried out on selected samples coming from the investigated sequence at different altitudes (fig. 5). Quantitative diffractometric analyses were obtained by using the method proposed by Rietveld (1967) and processed by MAUD computer program (Lutterotti & *alii*, 1998).

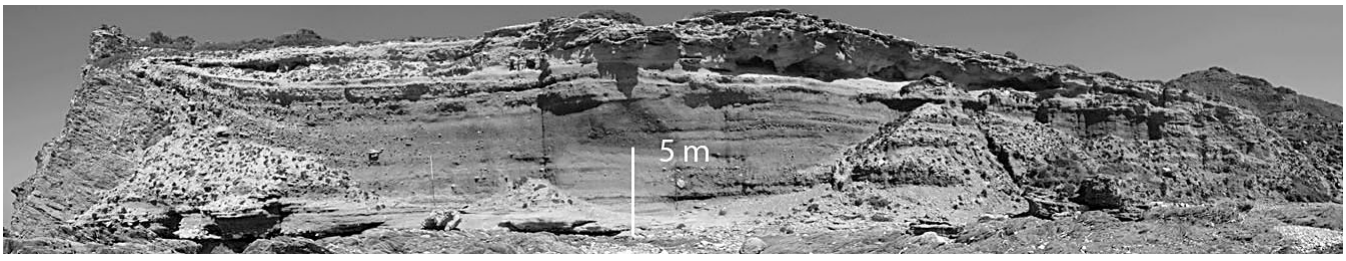

FIG. 4 - The Ebidozzi filling. Note the occurrence of the original shape valley.

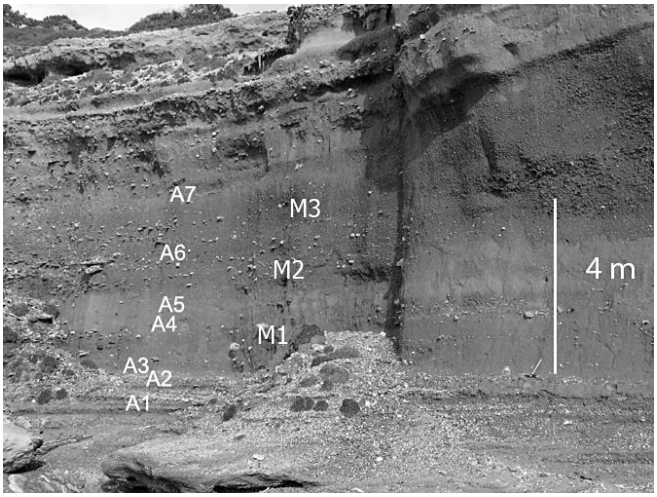

FIG. 5 - Localization of analyzed samples in the Ebidozzi cliff.

ANALYTICAL METHODS

The *X*-ray diffraction (XRD) patterns were recorded overnight using Bruker D8, Philips PW-1050, Siemens D-500, Rigaku D/MAX diffractometers in the Bragg-Brentano geometry with CuKα radiation (λ = 1.54178 Å). Selected samples were powdered with a Spex Mixer-Mill mod. 8000, employing stainless steel and hardened-steel milling media. Two grams of powder and a single milling sphere of 3.5 g were used in each treatment. The goniometer was equipped with a graphite monochromator in the diffracted beam and the patterns were collected with 0.05° of step size. The *X*-ray generator worked at a power of 40 kV and 30 mA and the resolution of the instruments (divergent and antiscatter slits of 0.5°) was determined using SiO_2 and Al_2O_3 standards free from the effect of reduced crystallite size and lattice defects. The powder patterns were collected in the 6°-140° angular range, with counting time of 40 sec per point and were analyzed according to the Rietveld method, using the MAUD computer program (Lutterotti & *alii*, 1998). Fig. 6 shows a typical observed pattern (data points) fitted using the structure factors of involved minerals (full lines) from which the quantitative evaluation was obtained. Obtained data can be summarized as follows:

A1 (3.25 m s.l.ms.) and A2 (4.05 m s.l.ms.) samples located below the fossiliferous marker and representing the palaeobeach deposits, show similar undistinguishable composition dominated by quartz (58-70%) and subordinate amounts of sericite (12-32%) and calcite (10-17%). Accessory amounts of halite (2%) are observed in the A1 sample.

Samples A3 (4.15 m s.l.ms.), A4 (5.65 m s.l.ms.), A5 (6.05 m s.l.ms.), A6 (7.25 m s.l.ms.), referring to continental deposits, show mineral phases composition dominated by sericite in the range of 60-74%, quartz (13-20%) and chlorite (10-17%). Minor amounts of halite that does not exceed the 5% are observed. Sample A7 located not far from the top of the continental mixed level (8.55 m s.l.ms.), shows quite higher amounts of halite (22%) and chlorite (23%).

Except for talus coming from Palaeozoic basement and represented by sericite, quartz and chlorite, it should be evidenced the occurrence of halite likely related to the climate arid variations.

Morphometric analyses were carried out on same samples in order to obtain the rounding degree of pebbles. In the sampled section we distinguish three areas of about 1 m^2 named M1, M2 and M3 (fig. 5). 55 pebbles were collected in the M1 area (30 of quartz and 25 of phyllites), 63 in M2 (47 of quartz and 16 of phyllites) and 85 in M3 (82 of quartz and 3 of phyllites). From the comparison of the pebbles results:

- in M1, the pebbles of quartz show a degree of rounding from 0.1 to 0.4, while phyllites range from 0.2 to 0.5;
- in M2, the pebbles of quartz may be classified from 0.1 to 0.6, while those phyllitic range from 0.2 to 0.5 respectively.

In M3, the pebbles of quartz show a degree of rounding from 0.1 to 0.8, while the only 3 pebbles phyllitic show values of 0.5-0.6 and 0.8.

In summary, sample M3 almost belonging to the beachrock horizon, contains the highest incidence of quartz pebbles as well as the highest rounding index, confirming the occurrence of the palaeoenvironment and palaeolandscape. M2 sample, located at the bottom of the aeolian deposits, shows pebbles with lower rounding degrees in comparison with M3 sample as well as the increase of the incidence of phyllitic fragments coming from the proximal relief slope. M1 sample, located at the bottom of aeolian

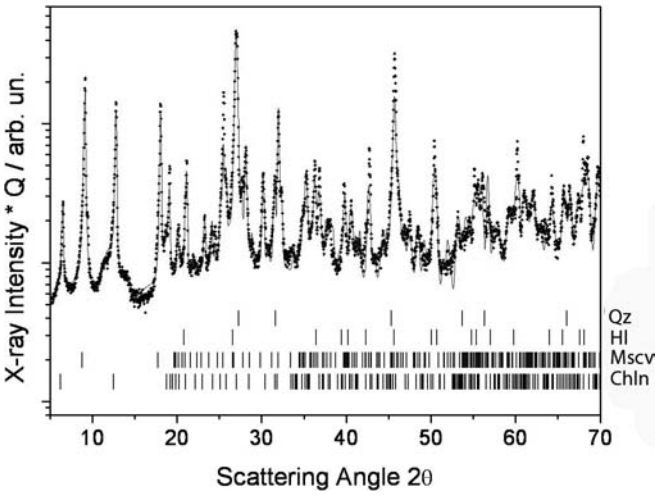

FIG. 6 - The X-ray pattern of specimen A6 examined according to the method proposed by Rietveld (1967). Dots are data points while the full line is the fit using the structure factor of each phase reported at right of the plot, weighted for their weight percentage. The agreement between crystallographic model and experiment may be biased by the presence of other minor phases, texture, anisotropy etc. Abbreviations: Qz, Hl, Mscv and Chln refer to quartz, halite, muscovite and chlinoclore respectively.

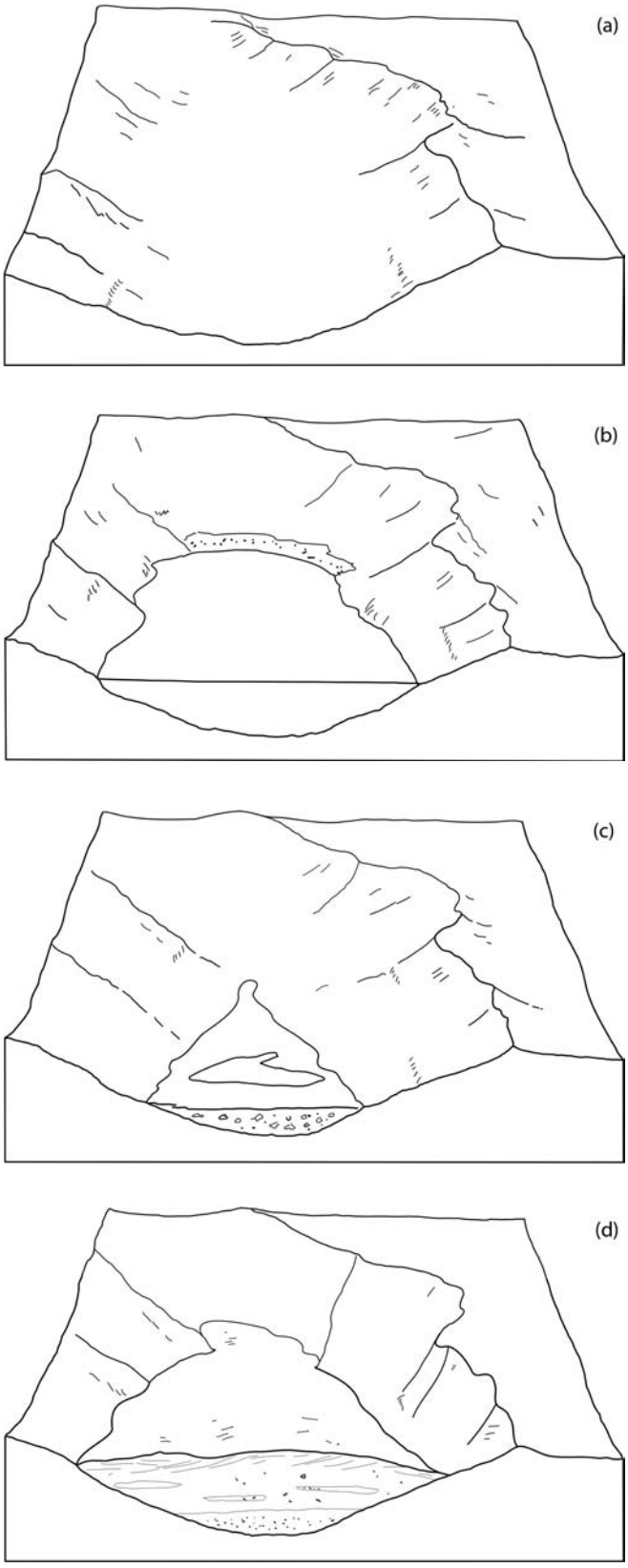

FIG. 7 - Schematic block diagrams (not to scale) for Ebidozzi palaeovalley evolution. (a) Pre-Tyrrhenian times; (b) Tyrrhenian; (c) early post-Tyrrhenian regression; (d) maximum of post-Tyrrhenian regression.

horizon, shows pebbles with degrees of rounding smaller in comparison to M2 and M3 and a larger incidence of phyllitic fragments, in good agreement with the proximity of the slope, confirming the detrital nature of this portion of filling.

CONCLUSIONS

The last climatic regression phase produced the wide expansion of coastal areas without vegetal covering which were exposed to the erosional processes dominated by NW winds favoring the deposition of wide dune fields. This scenario is well preserved at the top of the Ebidozzi section characterized by several episodes of aeolian sediments often reworked under diffuse rill conditions. The *calcrete* levels observed at the top of stratigraphic sequence, indicate fast evaporation conditions of the water from the grounds. After the dune field formation interglacial conditions are recorded as testified by local pedogenetic evidences.

The common occurrence of halite in the sampled levels confirms that the slow coastal evolution characterized by local and ephemeral coastal ponds distributed at the bottom of the relief. During post-Tyrrhenian times, the successive increase of the relief energy produced a fast erosion phase and the progressive infilling of the Ebidozzi palaeovalley (fig. 7).

The good geological exposure of the investigated section allows us to evaluate the erosion index of Ebidozzi basin on the basis of a volumetric calculation of post-Tyrrhenian deposits. The infilling palaeovalley cover, was previously divided into several simple prism to obtain an average data using the Autocad® computer program. Geometric figures have been constructed on the basis of the measurement of the Palaeozoic basement/studied deposits contact dip compared with that offered by the digital cartography (fig. 8). The obtained volume is about 40000 m^3. Assuming a uniform erosive process for the last 80 Ka, it

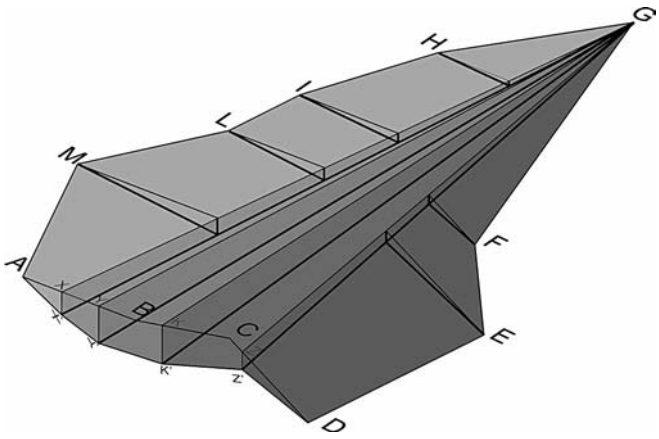

FIG. 8 - Reconstruction of Ebidozzi valley filling calculated by simple geometrical figures processed with Autocad® computer program. Letters refer to the prism apexes chosen for the volume calculation.

can be evaluated an erosive value of about 0.5 m^3/year of deposits accumulated in the investigated palaeovalley. Although the obtained erosion index represent an approximate value, it constitutes a first attempt of evaluate the efficiency of the erosive processes during post-Tyrrhenian to Holocene cold climatic phases. At the present time however, it appear quite difficult to model the incidence of aeolian input during the infilling processes of Ebidozzi palaeovalley.

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