

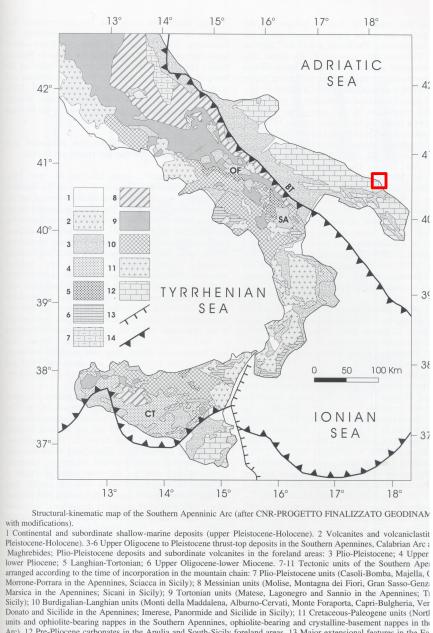
The warning of sediments for the conservation of the environment

Introduction

The height of the sea level is not constant over time, but varies on a global scale as a function of increasing or decreasing the volume of water available in the oceans: this variability depends essentially on the climatic oscillations induced by periodic changes in the orbital parameters of the planet. A decrease in the average temperature on the Earth corresponds to a contraction of the volume of ocean waters and an increase of that of the ice "perennial" (the so-called glacial phases); in periods with higher average temperatures (the interglacial phases) part of the ice cap melts resulting in a consequent increase in available water volumes.

The most recent IPCC (Intergovernmental Panel on Climatic Change) forecasts suggest a rise during the century that could even be a few tens of centimeters with very significant effects on a local scale. By way of example, it should be remembered that the ascent of the sea level occurred during the Roman era did not prevent many ports of the imperial age, built in correspondence with coastal plains, to be several kilometers away from the shore line already in the Middle Ages, due to the progress towards the sea of alluvial sediments accumulated by the activity of the main watercourses. This poster describes some aspects of this rise in the province of Brindisi.

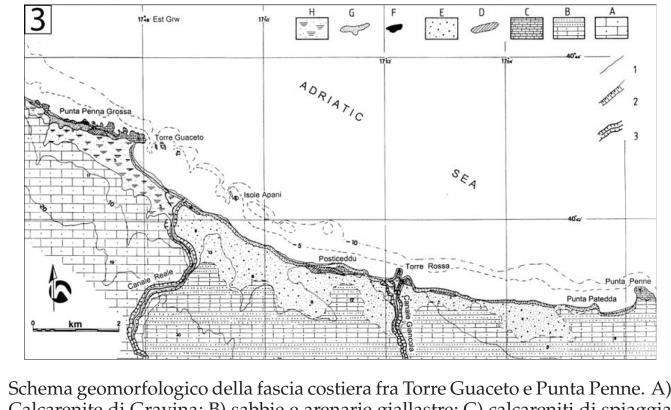
The province of Brindisi is situated in the Apulian foreland, formed during the Apennine orogeny and consists of a succession of powerful carbonate platform rocks. The pressures related to the different tectonic phases have only marginally affected the foreland, generating essentially disjunctive structures such as fractures, normal faults and mild broad-folds. In particular the territory of Brindisi is on the border between two blocks of Apulian foreland, Murge and Salento, characterized by some differences in the geological-structural aspect.



The Murgia area consists of an extended raised block, bordered both on the Ionian coast to the Adriatic by extensional structures with staircase blocks. More complex is the structural setting of the Salento, characterized by a series of Horst and Graben variously extended, generally oriented in the direction NW-SE. The plain of Brindisi coincides with a wide structural depression open to the Adriatic coast, which affects the foreland carbonate rocks, in which you have deposited sediments of the filling cycle of Bradano trough and terraced marine deposits that make up the shallow aquifer. Above the Mesozoic carbonate substrate, there is an outcrop of the terms calcarenitic and clay of sedimentary cycle of Bradano trough of Pliocene age, on which rest the most recent terraced bioclastic deposits of shoreline environment and Holocene and current continental deposits. The morphological structure of the Brindisi area, generally flat, reflect the tabular structure of the Plio-Pleistocene deposits and Mesozoic outcrops. The morphological element that characterizes the area is the presence of a series of terraced surfaces sloping toward the Adriatic Sea and bordered by modest and discontinuous slope falls on ancient shorelines. The hydrographic network is well developed locally and generally characterized by numerous shallow drainage lines. In the vicinity of the coastline, particularly to the south of Brindisi, there are wetlands at the mouth of streams and / or emergence of groundwater.

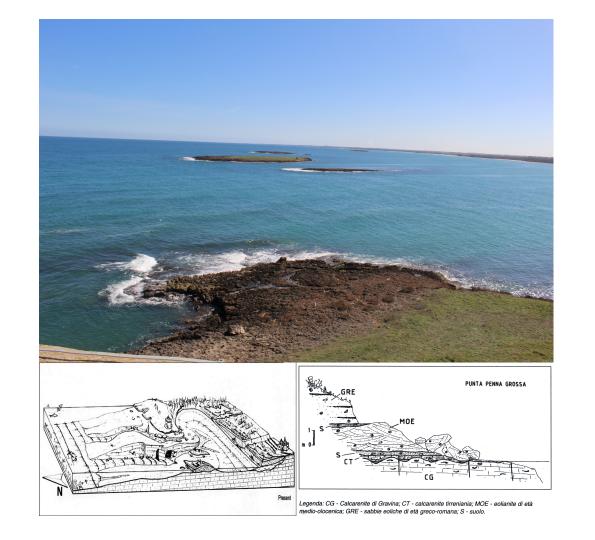
The original geomorphological structure was largely intensely modified by human activities; particularly important was the cultivation of the soil made by the farmers, which modified locally even the natural outflow lines of surface water.

Torre Guaceto



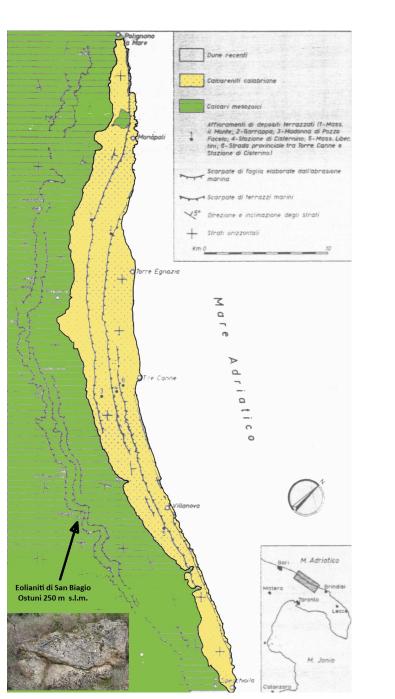
tirreniane; D) eolianiti tirreniane; E) sabbie rosse lagunari tirreniane; F) eolianiti

The tract that extends from Punta Penna Grossa to Torre Guaceto is characterized by a large sandy beach, surrounded by towering dunes and fossil wetlands behind the dunes covered by a thick Mediterranean maquis, with numerous examples of arboreal holm-oak and juniper. After passing several rocky bays in a crescent shape, you reach the grassy plateau of Guaceto Tower, topped by a fortified building, located on a small promontory that closes the bay protected by three islets. Here, the sandy and linear coast is bordered by very evident active and fossils dune cordons, the backs of which extend fragments of marshy areas. In particular, the first cordon of dunes is the backbone of the coastal relief, and was formed during the Holocene average. C^{14} analysis of *Helix sp.* indicates a cordon age of about 6000 years ago. In a subsequent step, a different sedimentary episode has determined a second accumulation on the previous dune. C¹⁴ analysis of samples of *Helix sp.* indicates an age of about 2500 years ago for the second cordon of dunes. The coastal area of Torre Guaceto is characterized by the presence of a low rocky coast that, where possible, is home to pocket beaches. The overlap of the dune cord Holocene on the Tyrrhenian, obstructing the flow of shallow coastal aquifer waters, in relation to sea comeback, has allowed the construction of a wetland behind the eponymous tower. The surface of the pond is just above the sea level. Calcarenite di Gravina; B) sabbie e arenarie giallastre; C) calcareniti di spiaggia The three islands are the edges of the Tyrrhenian dune that you continue in several adjacent locations (as of Apani rocks) and that medio- oloceniche; G) eolianiti greco-romane; H) depositi retrodunari e lagune; somehow allows you to identify the position of the sea level and the shoreline of about 125000 years ago. 1) sabbie di spiaggia; 2) falesie; 3) incisioni fluviali.



In this area, and especially in the tidal range in front of the headland of the Tower, are evident the archaeological structures related to the Bronze Age: there are also some pole holes, excavated by various shapes and sizes, at least partially excavated in the Tyrrhenian dunes of calcarenite and sometimes lacking in their filling, unequivocally marking the space created by the artificial world of the second millennium BC. The site is located on Apani islands (also called Cliffs of Apani), moderately sized islets about 500 m from the resort's coast Apani, north of the city of Brindisi, part of the Marine Protected Area of the State Natural Reserve Torre Guaceto. The islands are formed from strips of old Tyrrhenian dunes that allow you to identify the position of the sea level about 125000 years ago. The study of geoarchaeological markers allowed to place the sea level at that time 3-4 meters lower than at present; thus it can be assumed a scenario where the north coast of Torre Guaceto should be less jagged promontory of the bay and present harbour in South represented a wide rich coastal plain ponds fed by channels corresponding the current Canale Reale and Apani, while current islets were united to the mainland. The presence of a deep blade situated between the promontory of Torre Guaceto and neighboring islets, allowed the boats to access a safe harbor to the south side of the cape; today this blade is completely submerged. The islets have been detached from the mainland as a result of sea transgression over the past 6/7 thousand years when his station began the profound erosion of retrodunal uncemented deposits. At this stage the islets of Torre Guaceto represented the morphological high that dominated an extensive paralitorale basin that stretched to NO for a few hundred meters. This place is known for the ancient presence of a safe harbor and the wide availability of fresh water, both spring that brought by the Reale and Apani channels: these elements have led to a stable human presence at least since the second millennium BC the late Middle Ages.

Geological outlines



The Brindisi coast represents the end of a plain engraved by shallow furrows torrential and bounded by weak undulating hills that slope towards the sea. The coast is low and characterized by a trend little uneven and rather linear; there are both sandy stretches, often accompanied by the presence of dune cordons, marshes and dune lakes, both traits in soft rock, with the presence of a cliff sections (also anthropogenic). The coastal profile is divided into a continuous succession of stretches of beach, straights or strides, usually edged by coastal dunes and cords, and rocky stretches with banks, with differences in height between a few meters up to over a hundred, generally jagged and, to places, surrounded by garlands of islets and rocks located a short distance from the coast. The current conformation of the Apulian territory has been reached in recent times, in practice by the maximum regressive of the last glacial, which occurred about 18,000 years ago. The marine comeback, linked to the subsequent deglaciation (Versilian transgession), seems to have manifested itself in two distinct phases. A first one that lasted about 6-7000 years ago, it would have been characterized by a rapid lifting of the sea and by an equally rapid succession of constructive-destructive cycles of the coastline. The average sea level would have risen, in a short time, from about -120 m up to about ten meters below the current level. The forms modeled during this phase are now all submerged and are represented by strips of dune and beaches, coastal ponds,

platforms of abrasion etc. The next phase seems to have been characterized by movements that are generally slower and in any case smaller. Furthermore, recent research suggests that in the last 6-7000 years, the average sea level has undergone continuous oscillations of various amplitudes. The current level would have been reached, as proven by some archaeological evidence, only in historical times. The Adriatic coastal strip shows relief shapes characterized by a series of well-developed slopes, connected to each other by wide spread spans: these are the so-called coastal terraces. Both the terraces and the esplanades are arranged at various heights on the sea level thus giving the landscape a characteristic level with steps. A large part of these slopes corresponds to the paleolines of the shore, while the planes are interpreters as abrasives paleosurfaces. The latter to places conserve residual limbs of marine deposits in coastal facies and stretches of beaches, coasts and consolidated dunes; on the same paleosuperfaces are also present traces produced by sessile marine organisms: lithodomas, bryozoans, barnacles, sponges and more rarely corals as well as places also stromatolites and encrusting algae. Shoreline furrows that represent traces of wave motion are not uncommon. Terraced marine deposits, referred to several short transgender-regressive sedimentary cycles, consist of both emerged and submerged beach and dune sediments. In the area of the Murge, 16 coastal paleolines have been recognized, which rise from about 340 m to 2-6 m at the current sea level.

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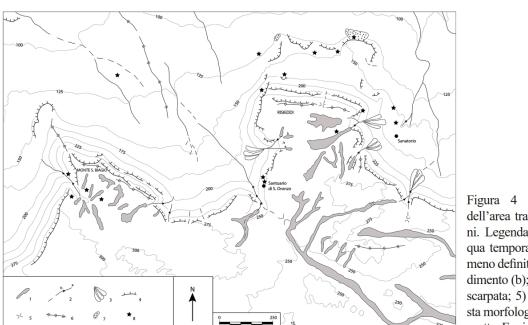


Figura 4 - Carta geomorfologica dell'area tra Monte S. Biagio e Ostuni. Legenda: 1) lama; 2) corso d'ac-qua temporaneo (a), tratteggiato dove meno definito, localmente in approfondimento (b); 3) conoide alluvionale; 4) scarpata; 5) sella morfologica; 6) cresta morfologica; 7) cava; 8) ubicazione grotte. Equidistanza 25 m.

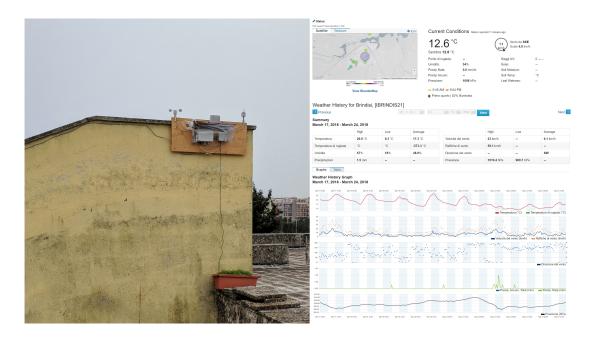
Moving to the hinterland, the sector in question is subsequently subject, at least until the late Pleistocene, to a series of oscillations related to glacio-eustatic variations of the sea level and to the regional tectonic upheaval, which is witnessed in Puglia from the end of the lower Pleistocene. The area of Agnano emerges progressively from the sea during the late Middle Pleistocene. The emersion determines the presence of coastal and continental conditions, with repeated oscillations in connection with the glacial phases. At this stage, the formation of the wind deposits of Monte S. Biagio occurred, when the ancient coastline was attested around the altitude of 250 m s.l.m. In fact on the cretaceous limestones extending out over the entire slope there is a residual limestone of calcarenites. The contact between limestones and calcarenites is abrupt and irregular: the angular mismatch is very clear, in fact the limestone has a sub-horizontal position, on the contrary the calcarenitic layers show inclinations up to 30° with reggipoggio immersion. The consist of a small outcrop often a few meters: it is a deposit with a constant granulometry with granules of an average of 1 mm. The fossil remains are very scarce. The calcarenites are interpreted as original calcareous wind sands (eolianites) that have accumulated against the slope forming dune bodies. Eolianite or aeolianite is any rock formed by the lithification of sediment deposited by aeolian processes; that is, the wind. In common use, however, the term refers specifically to the most common form of eolianite: coastal limestone consisting of carbonate sediment of shallow marinebiogenic origin, formed into coastal dunes by the wind, and subsequently lithified. It is also known as kurkar in the Middle East, miliolite in India and Arabia, and grés dunaire in the eastern Mediterranean.



The formation of the Eolianites of San Biagio refers to the sedimentation phase of the Calcarenites of Gravina del Pleistocene Inferiore when the sea level was supposed to be close to the current elevation (250 m above sea level). In this period, from the calcareous sands that formed the ancient beach, the finest fraction was removed by the dominant winds coming from the North. This fraction was redeposited to the ground against the morphological slope formed by the top of Ostuni, resulting in the assumption of carbonate wind dunes. The presence of the fossil dune 250 m s.l.m. demonstrates the existence of a paleocosta and the raising of the region after the formation of the eolianites. The Cave of Santa Maria di Agnano opens at the foot of the promontory of Risieddi, on whose summit a settlement of the Age of metals has been found. Described in works of the late nineteenth century by the scholar from Salento De Giorgi (1882, 1897), who pointed out the presence of a ruined altar with the remains of a fresco, the cavity was then repeatedly mentioned among the Apulian hermit crypts. Furthermore, it was also known for the discovery of cavernous fauna. It owes its fame to the Upper Paleolithic funerary complex discovered at Ostuni in 1991 in the Santa Maria di Agnano cave (Ostuni, Apulia, Italy). To date, two primary burials, Ostuni 1 and Ostuni 2, have been discovered at the site. Ostuni 1 grave contained the skeleton of a young woman (Os1). She was 20 years of age or younger and in the advanced stages of pregnancy at time of death. Her skeleton was discovered in an excellent state of preservation, and was richly adorned with hundreds of perforated shells around her wrists and covering her head. The shells covering her head were pasted together with red

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Classroom work



During the school year 2017/2018 pupils of Istituto Comprensivo Sant'Elia Commenda class 1C, have followed a regula course of studies which includes notions of subject sciences including fundamental physical elements as pressure, volume, weight, specifi gravity, strength, temperature, heat All these arguments have been explained in various situations Subsequently, the of experience. concept of the Earth was studied as a system in equilibrium between its components: the atmosphere, the hydrosphere, the biosphere and the lithosphere. After the introduction of these notions, the scientific analysis fundamental elements of some (temperature, humidity, air pressure was introduced, deepening relationship between climate geographical areas.



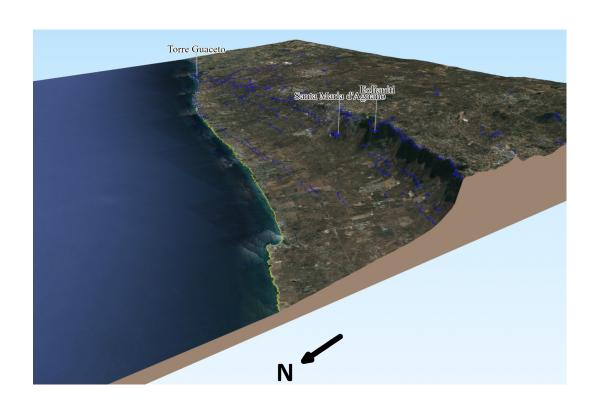
is dedicated to air pollution; concepts of chemistry and physics are already called presented and this allows to make sure of the competences reached the students. Great importance is given to problems related to the ozone hole, to acid rain, to the phenomenon of "El Niño", to the intensi fication of the greenhouse effect. cilitate the correlation between climate and weather, we took the oppornity to install a very efficient mete orological station on the roof of the school. In 2016, the Raspberry Pi Oracle Weather Station programme distributed nearly 1000 weather station kits to schools around the world. With this programme, was given youns people the opportunity to partake i cross-curricular computing and science projects that cover everythin from embedded IoT and networking protocols to databases and big data.



A fundamental part of the program The Oracle Weather Station include The didactic activity complementary the islands of Torre Guaceto and the dress: https://goo.gl/A8Q3Pz

San Biagio in Ostuni





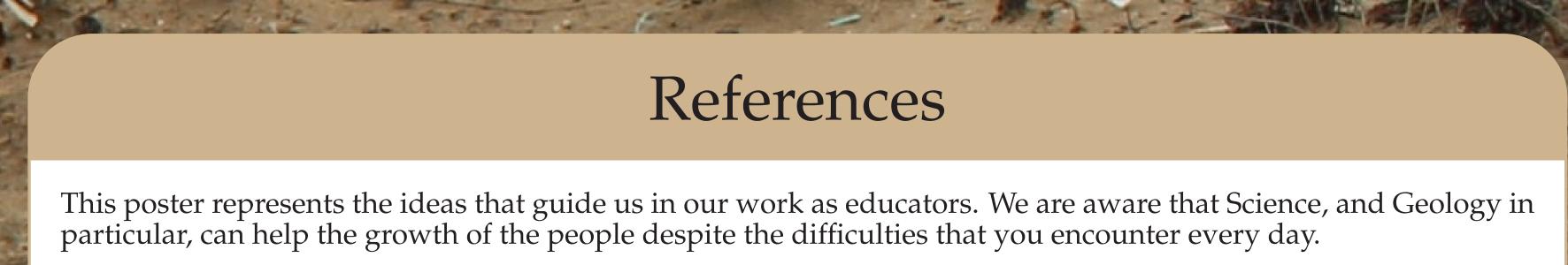
sensors to capture everything from to what has been learned in the class rocks of Apani. soil temperature to wind speed and includes some excursions in the ar- Later, the students visited the Rehabilbarometric pressure. In our specific eas indicated: Torre Guaceto, San Bi- itation Center for Sea Turtle (Centro case the installation of a weather sta- agio in Ostuni, Santa Maria di A- Recupero per le Tartarughe Marine), marine inertia and making references tion on the roof of the school gave gnano. With the funding obtained located in Punta Penna Grossa, named to the glaciations incurred in the last the students the opportunity to un- through the Erasmus + program, the after Luigi Cantoro, historical Brindisi one million years. derstand the process of defining the excursions were attended by about WWF activist who has dedicated his In the following days two other exclimate of a region. In fact, day by 50 students of the first classes of the life to the defense of Torre Guaceto. cursions were organized: the first in day, all the year, the students hold Istituto Comprensivo Sant'Elia Com- The center's main objective is the pro- the Torre Guaceto marine reserve on the data of the main climatic factors. menda Brindisi. On 9/03/2018 a tection and conservation of sea turtles, 23/03/2018 with a different route than The following set of sensor measure- group of young people went to the through the rescue, care and rehabili- the first excursion. On this day the stunents for the weather station is set- natural reserve of Torre Guaceto to ob- tation of specimens found in difficulty. dents were introduced into the natutled: Rainfall, Wind speed, Wind gust serve the formation of fossil dunes on Its activities include research, conser- ral environment of the reserve with a speed, Wind direction, Ambient tem- Penna Grossa beach. The eolianite vation, information and public aware- visit to the museum of the reception verature, Soil temperature, Barometric formed about 6/7000 years B.C. has ness on the protection of marine life, center. Afterwards, a practical activpressure, Relative humidity, Air Qual- been recognized in its essential fea- and especially turtles. y, Real Time Clock (for data logging tures (grain size, texture and strati- During the same day it was pos- ing to the Mediterranean maquis was purposes). The weather station is in graphic layering) and in the place sible to go to the area of San Bi- organized. On 17/04/2018 there will operation 24/24 and has a webcam have been expressed considerations agio in Ostuni on the outcrop of be a third excursion to visit the Muhat takes a picture of the meteorologi- on the chronostratigraphic context of the Eolianites going back this time seum of Preclassical Civilizations of cal situation every 15 minutes; the col- the formation of the dunes in consid- to the Lower Pleistocene, when the the Southern Murgia and the Archaeolected data and the slowmotion of the eration of the shore line left by the pre-shore line reached the hinterland seve-logical Park of Santa Maria di Agnano photos taken are available at the ad- vious marine regression (125000 BC in ral kilometers away from the current in Ostuni. stadium 5e) led to the formation of coast.





In this way the serve two similar lithological formations (the eolianites) carrying out the considerations on the phenomenon of

ity of recognizing vegetation belong-



The maps and diagrams of this poster are from:

- Guide Geologiche Regionali " Puglia and Monte Vulture " BE-MA Editrice

- "Geology of Italy" Special volume of the Italian Geological Society for the I.G.C. 32 Florence 2004

Scarano T. et alii "L'archeologia del paesaggio costiero e la ricostruzione delle trasformazioni ambientali: gli insediamenti di Torre Santa Sabina e Torre Guaceto (Carovigno, Br)".

- Mastronuzzi G. et alii "Middle-late Pleistocene evolution of the Adriatic coastline of Southern Apulia (Italy) in response to the relative sea-level changes"

- Di Geronimo "Geomorfologia del versante adriatico delle Murge di SE (zona di Ostuni, Brindisi)"

- Coppola D. "Il riparo di Agnano nel Paleolitico Superiore. La sepoltura Ostuni 1 ed i suoi simboli"

We thank the management of the reserve and driving Andrea Motolese.

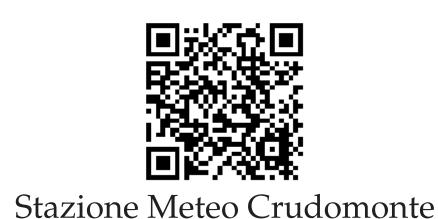
Thanks for participating in the working class the teachers of the Istituto Comprensivo Sant'Elia Commenda Brindisi Antonio Tundo and Paola Manfreda.



With this gr-code it is possible connect with Youtube to see a movie about 33 minute in which he describes the visit to the reserve of Torre Guaceto and to San Biagio in Ostuni (https://youtu.be/dfBsiHIZEO8)



Istituto Comprensivo Sant'Elia Commenda Brindisi http://www.comprensivosanteliacommenda.gov.it/



Riserva Marina Statale di Torre Guaceto Carovigno Brindisi http://www.riservaditorreguaceto.it/

This poster was made by LAT_EX

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Istituto Comprensivo Sant'Elia Commenda Brindisi https://goo.gl/A8Q3Pz