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# An unusual tumulus or cenotaph at Cozzo Rotondo, town of Grifone (Bisignano, Cosenza, Italy). New and old geological investigation for an archaeological discovery

The hillock named "Cozzo Rotondo", in Grifone (Bisignano, province of Cosenza, Italy), has attracted the attention of numerous researchers since 1986, when it was discovered, and – owing to its peculiar morphology – is described as a monumental tumulus. This research, integrating old unpublished data and new ones, aims to define its internal structure and how it was made. In fact, its shape is in striking contrast with the geomorphological context of the surrounding area. Its shape, orientation and spatial setting recall many tumuli of Central Europe. A series of popular myths and legends, as well as its curious name, are associated with this hillock, conferring it a certain halo of mystery. The geological, geophysical and geomorphological investigations carried out in the past – in particular those quoted in this study – confirm that this hillock is made up of homogeneous sand arranged in natural layers and that its shape is the result of the digging and remodelling of a natural slope. Based on geomorphological observations, it has been estimated that the volume of earth dug out is about 8,000 m3, concentrated nearly exclusively in the southwestern sector of the hillock, where the soils are more recent and thinner. Subsequently, the material was scattered in the underlying plain, thus forming a gentle bluff, some 1-2 m thick, over an area of 4,000 m2, as confirmed by georadar surveying. In particular, geological investigations carried out on a series of excavations have clearly shown the presence of a moat surrounding an ancient building and a clayey colluvium, which were dated to the 8th century CE (by means of 14C dating) and after the 8th century BCE (by means of fluorescence analyses), respectively. It was therefore suggested that the digging and remodelling activities took place in this time interval. Geoelectrical and georadar surveying seems to show the absence of voluminous finds, strengthening the hypothesis – expressed also by many archaeologists – that the hillock of Cozzo Rotondo is a quaint tumulus resulting from accurate partial modelling, almost totally made by a sort of "deep carving". More likely, it is a monumental cenotaph, built in a very original way.

#### Introduction

Since January 1986, numerous researchers have carried out investigations on the hillock named "Cozzo Rotondo" (Fig. 1), located in Grifone (southern Italy; Lat. 39.57075539; Long. 16.26709878), within a valley on the right hand side of the River Crati (Rizzo, 1986a, b). After informing the local authorities on the scientific interest of the site, research aimed at understanding the lithological composition and

the morphogenetic aspects was undertaken<sup>1\*</sup>, thus confirming the partial artificiality of the hillock, made by a modelling of a natural slope.

By integrating new and old data, this research aims to explain the nature of the Cozzo Rotondo hillock and its constructive patterns, providing more assessment elements for future historical and archaeological investigations.

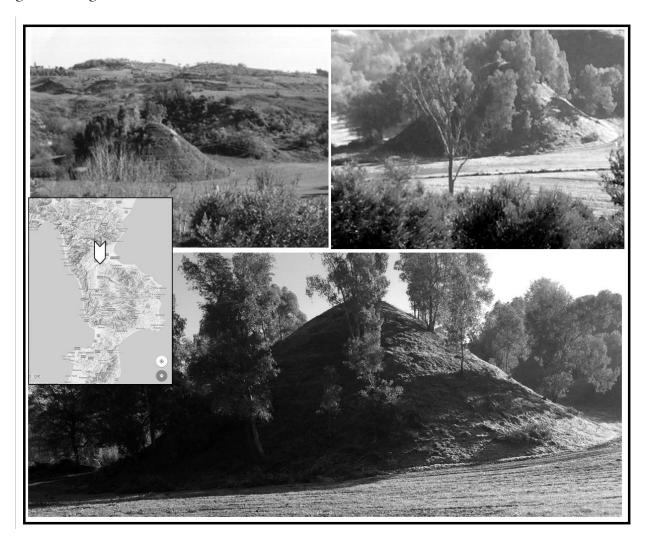


Fig. 1. Views of Cozzo Rotondo from the west, at the entrance of the Grifone valley. Top left: picture from 1986. Top right and bottom: the hillock today.

### Physical and Cultural Setting

As soon as the first investigations were carried out (Rizzo, 1986a), mainly by means of superficial excavations by hand, syngenetic structures of littoral-marine environment were discovered; they are particularly well preserved on the SW and NE sides.

The peculiarity of the hillock shape and the sharp contrast with the surrounding geomorphological environment have stimulated in-depth research, involving other scientific disciplines, such as geo-

During the International Conference, held in 1993 in Bisignano (Cosenza), entitled "Geoarchaeology of Tumuli in Ancient Europe" (whose proceedings were not published because of the death of Prof. Tony Hackens, Director of the PACT review), several archaeologists – specialists on tumuli of different ages and cultures of European countries – recognized its undoubted archaeological nature as a burial site (tumulus or cenotaph).

morphology, archaeology etc. In addition, another campaign of borings and geophysical soundings was carried out.

The plain around the hillock was a strategic area, a point to cross to reach the coast and move to Lucania region. Just on the opposite side of the river Crati is running the roman Via Popilia. The site for this reason was interested by numerous historical events and battles. It is located at the border of ancient Brutium (of which then nearest Bisignano and Acri towns were part) and it is very near the ancient Thurium, involved by greek colonization.

Preliminary studies, carried out by the CNR Institute of Applied Technologies of Rome, did not produce significant results, apart from a light geoelectrical anomaly of dubious meaning in the southern portion of the site (Rizzo, 1986c). Soundings executed at the top of the hill permitted to identify the surface nature of the ground. Further excavations at the base of the hillock suggested the hypothesis of a geomorphological origin with partial anthropogenic excavation and landfill interventions (Panizza, 1986; Rizzo, 1986c; Panizza and Rizzo, 1989).

The scientific interest for this unusual shape is also derived from the numerous legends regarding this site and from toponymy, since the name "Grifone", besides being unusual for Calabria, shows evident archaeological implications (Rizzo, 1986b). The author suggested that Cozzo Rotondo was a monumental cenotaph (Rizzo, 1986c), which could have been erected for an important historical personality who had died in the Crati valley. In particular, Velizar Velkov, sustained by other archaeologists, proposed a connection with the death of Alexander Molossus (Velkov and Naidenova, 1993). Nevertheless, dubitative relations to Alaric burial were formulated since some evidence was found in historical documents. In fact, the connection with Alaric is only toponymic: Pagano (1857) and Curia (1985) observed that around 70 CE the name Bisignano was Bisuntinus, which is quite close to the name Busento indicated in GIORDANAE for the burial of Alaric. Nevertheless, Gibbon (1854) marked it as a mistake, since present-day Busento used to be named Basentinus. Hence the hypothesis that this cenotaph could be the large excavation "in pede montis" in the valley of the Bisuntinus territory (Rizzo, 1986b, c).

#### Methods

In order to define the structure of Cozzo Rotondo and to understand how it was built, we combined existing unpublished geophysical, geomorphic, pedological and stratigraphic approaches, including samples dating, with recent new georadar (GPR) and geoelectrical profiles, acquired directly in the field.

In particular, two new georadar profiles were obtained: one to detect the thickness of cover soils and the structure of the hillock (profile 2); and another one, outside the hillock, along a line we suspect was subject to excavation and deposition of earth material, due to the carving work of slope modelling (profile 1). Geoelectrical investigations were carried out along the same georadar line 2 in order to collect further overlapping geophysical data and compare new data with old ones.

Resistivity measurements in the field were carried out by means of the multi-electrode method. In particular, an ABEM, Terrameter LS model, 4-channeled georesistivimeter was used with galvanic insulation, induced polarization and spontaneous potential. By this way The instrument is capable of a simultaneous management of 81 electrodes. The elaboration of geoelectrical data was realised by means of a bi-dimensional model with the use of the "RES2DINV" software for data inversion. This allows the production of hypothetical real resistivity models and calculation of the synthetic values of apparent resistivity in relation to the type of array utilized. The values thus calculated are compared in iteration cycles with the measured values, until the error can be considered minimum. The final model of real resistivity is the one that produces calculated apparent resistivity values closest to the measured

ones. The more the section of calculated apparent resistivity values approaches the ones of measured resistivity, the better the reliability of the final real resistivity model. The elaborations produced were synthesized by means of resistivity tomographic models (sections), where the values of specific electrical resistance are represented in a chromatic scale, by interpreting also their lithological meaning.

As for georadar investigations, considering the goal of the research and its context, an aerial centred on the 160 MHz frequency was used. This frequency is relatively low and does not provide a high resolution power; nevertheless, considering the lithological types, it allowed a discrete depth of investigation of 8 to 10 m. Georadar Ground Explorer model (HDR), constructed by Mala Geoscience, was used for data acquisition. The elaboration process, carried out by means of the Reflex-W commercial software, had as a result the reconstruction of bi-dimensional models, which allowed the associated anomalies to contact interfaces between soils with different electromagnetic characteristics to be reconstructed. In order to improve the signal acquired, radargrams were processed according to the following sequence: 1. T0 Correction and Background Removal; 2. Velocity analysis; 3. Deconvolution; 4. Migration. In particular, by means of T0 correction it was possible to identify precisely the beginning of soil penetration of the radar signal, whereas the velocity analysis defined the propagation velocity of radar waves into the soil. In this way, the exact depth of reflections/diffractions was defined and deconvolution (used only in some cases) allowed for the elimination of multiple reflections. On the other hand, migration permitted the elimination of the reflection hyperboles and the conversion of linear anomalies that were transversal to the scanning direction with point-like elements. The "shapes" of radar reflection were brought nearer to the real geometries of the reflecting elements. In this way, thanks to the various elaboration steps, an attempt was made to convert the images of the radar signals, resulting from the reflections/diffractions caused by buried objects, to their real shapes and positions as much as possible.

#### Results

### Geological and Geopedological Investigation

The geological formation cropping out at Cozzo Rotondo belongs to the Pleistocene cycle of the Crati valley, with sediments deposited inside a sedimentary basin characterised by two grabens, one stretching in a N-S direction (Crati Trough) and the other in a NE-SW direction (Sibari Trough). These structures were formed from the Lower Pliocene onwards (Burton, 1971). The Pleistocene deposits have been identified as belonging to three separated fan-shaped delta systems (San Lorenzo del Vallo, Bisignano and Cassano), which are characterised by different compositions of the clasts and related sedimentary structures (Colella et al., 1987). The Bisignano delta system unconformably underlies the San Lorenzo del Vallo system and is located in the innermost part (to the south) of the sedimentary basin. It is characterised by fine-grained deposits, corresponding in the study area to NW verging loose sand and silt, referable to the outer portion (northern) of the fan-shaped delta (probably a top set position dating to the end of the Lower Pleistocene).

In the Mid-Upper Pleistocene, the subsequent uplift caused the emerging of the present River Crati basin and the formation of vast terraced areas, some of which overlook the hillock from the adjacent slopes. The fluvial incisions of the present basins, including the Grifone basin where Cozzo Rotondo lies, should have formed at the latest between the end of the Pleistocene and the Holocene, that is before 12,000 years ago.

The Cozzo Rotondo sedimentary sequence, which was reconstructed from observations along the trench and from material recuperated during the 1986 borehole campaign, is made up of yellowish-

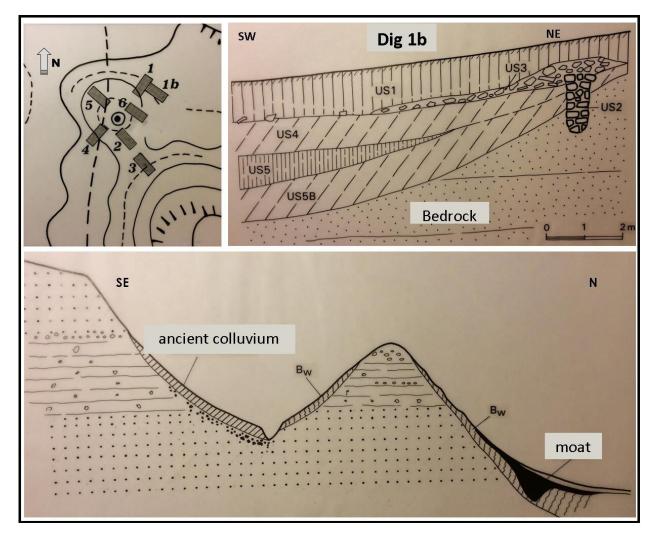


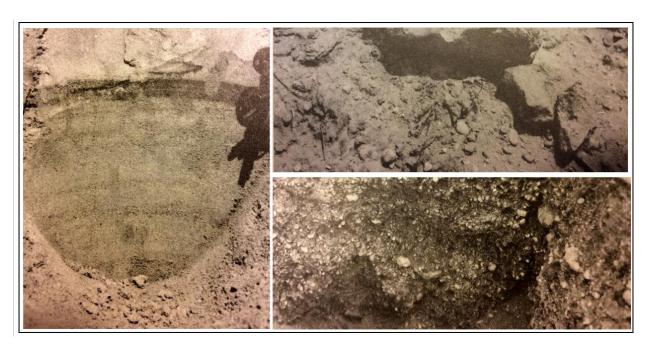
Fig. 2. Location of geophysical surveys (top left) and geo-pedological profile based on the results acquired (bottom). Top right: presence of an ancient construction on the hillock, thick layers of cambic horizon-type soils (Bw) and moat on the NE flank of the hillock.

brown sands from the topographically lowermost point (recently determined by means of GPS surveying at 98 m a.s.l.) up to the elevation of 102 m circa. Upwards, fine, equigranular, whitish or pale yellow sands up to the elevation of 115 m overlie them.

Dig Number	Horizon type (HT) or Stratigraphic Unit (SU)	Depth (cm)	Description
1	HT_A1	0-100	Poorly aggregated soil with considerable biological activity, gradual passage to the bottom
	HT_BW	100-200	Sandy texture, light brown colour (7.5 YR; 4/4), weak aggregation, brittle, gradual passage to the bottom
	HT_C	200-400	Sandy texture, massive, grey-olive colour
1b	SU_US1	0-150	Massive and brittle texture, rich in humus at the top, containing fragments of tiles, light-coloured (colour 1YR 3/2) lower boundary
	SU_US2	100-200	Ancient wall
	SU_US3	50-150	Broken masonry
	SU_US4	150-250	Frankly sandy and massive moat-filling material

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Dig Number	Horizon type (HT) or Stratigraphic Unit (SU)	Depth (cm)	Description
	SU_US5	200-250	Poorly developed concave bedding at the centre of section
	SU_US5B	200-400	Concave lens particularly rich in organic matter; at its base there is a considerable increase in charcoal fragments, from which sample T3875 was collected
		400-450	Bedrock, quite similar to the C horizon found at the base of Dig 1
2	HT_A1	0-60	Weathering horizon, which gradually turns to unweathered sands
		60-300	Sands with reddish variegations showing a slight planar bedding
3	HT_A1	0-150	Weakly expressed medium-prismatic structure with frankly silty- clayey texture
		150-160	Decimetric thick calcic horizon with fragments of ceramic mixture at the base (sample D906)
		160-180	Sand of the geological bedrock
4	HT_A1	0-30	Weathering horizon
		30-100	Sand of the geological bedrock
5	HT_A1	0-10	Weathering horizon
		0-30	Loose gravelly sand
		30-60	Weathering horizon
		60-100	Well-expressed, planar bedded of sand and gravel
6	HT_A1	0-100	Weathering horizon



 $Fig.\ 3.\ On\ the\ left:\ whitish\ sand\ with\ hints\ of\ plane\ bedding\ and\ reddish\ variegations\ of\ the\ type\ shown\ in\ Dig\ 2.\ On\ the\ right:\ loose\ gravel\ mixed\ with\ sand,\ probably\ de-structured,\ outcropping\ just\ at\ the\ top\ of\ the\ hillock\ (after\ Rizzo,\ 1986a).$ 

In the upper part of the sequence, from 115 m to 120 m, littoral sands with pebbles crop out. In the last metre, at the top of the hillock, chaotic sandy breccias crop out, which might have been destructured by past human activities (Rizzo, 1986a). Also based on georadar data, the sedimentary sequence seems to be slightly inclined to the SE and has correspondence with the outcrops of the SE adjacent slope (Fig. 2).

In order to obtain more detailed descriptions on the lithological nature of the hillock, six trenches (Digs 1-6; Fig. 2) were carried out in the spring of 1993 by the colleague Mario Cremaschi, from University of Milan. Their stratigraphic data are reported on Table 1.

The collected data show that at the foot of the hillock, on the north face (Dig 1; Fig. 2) a rather deep weathered profile occurs, where below a thick A1 organic horizon, enriched of colluvium material, there is a weathered B cambic horizon; the massive underlying sands do not appear reworked and make up the pedogenetic bedrock.

At the same place, although transversally and in an outer position, the horizon A1 grows considerably thicker, creating a sort of ditch that seems to contour the foot of the hillock along its northern margin. At the eastern margin of the dig, a stretch of wall was dug out (Dig 1b, Fig. 2). Briefly, the stratigraphic section described shows the remains of a mortar-fixed brick construction, which was built at the foot of the hillock and at the margin of the moat that surrounded it. The moat is partly filled with broken masonry that, in turn, is covered by colluvium connecting the slope to the valley floor. The latter is slightly inclined to the north. On Digs 2 and 4 (Fig. 2, Tab. 1), the geological sequences generally appear under weathered soil, showing slight planar bedding with reddish variegation (Fig. 3, picture on the left). Near the top (1,5 m below the hillock top; Dig 5, Fig.2) one can observe loose gravelly sand (of the type shown in Fig. 3, pictures on the right; cf. Rizzo, 1986a), gradually turning to a well-expressed, planar-bedded, sand with ripples marks. Laterally, the strata are slightly hooked due to creeping. In this case, the soil is particularly thin since it was deeply eroded and covered by colluvium resulting from slope reworking. In general, the maturity and thickness of the soils differ along the hillock slopes. On the northern side, they are more developed and darker in colour.

In order to acquire useful dating, two samples were collected: one (Dig 1b; T3875) containing organic matter (determined by 14C dating) and the other (Dig 3; sample D906) containing little ceramic fragments (by using thermo-luminescence analysis). These two samples came from the digs opened at the base of the hillock and from the saddle separating the latter from the terrace at its back, respectively.

### Geophysical Investigations

Two alignments (L1 and L2) were made. In the first one, some 90 m long, along the hillock axis (line 2), georadar survey (180 MHz aerial) and geoelectrical tomography in a NW-SE direction were carried out. In the second one, (Figs. 4-6) some 75 m long, which was stretched starting from the saddle separating the hillock from the terrace slopes (line 1) in a SW direction, georadar survey was performed. The elevations of the profiles and measuring stations were determined by means of Global Positioning System (GPS) topographic instruments.

Line L2. Geoelectrical Tomography. The resistivity profile, obtained with the pole-dipole model, shows a geoelectrical anomaly with an increase of resistivity on the SE slope of the hillock. A similar anomaly, positioned exactly in the same place, had been surveyed in the spontaneous-potential geoelectrical profiles carried out in 1986. A doubtful meaning was attributed to it (Rizzo, 1986c).

Nevertheless, by using the Wenner-Schlumberger resistivity model (Fig. 4), this anomaly disappears. Therefore, it could be explained as the fictitious result of the combination between analysis models

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and relief geometry. In general, the summit and frontal part on the NW side of the hillock appears more resistive, with a tendency that seems linked more to the general geological structure rather than to local anomalies.

Line L2. Georadar. The georadar profile shows horizontal discontinuities, with a sub-horizontal trend, in the upper part of the relief; they are likely linked to the stratification of the sediments (Fig. 5).

At the top of the hillock and on its NW slope, the georadar recorded a different response in the first 2-4 m of sediment. This is marked by a reflexion on an inclined plane, which is sub-parallel to the slope and disappears in the lower relief portion.

Georadar data seem to be consistent with geoelectrical data, as observed by the overlapping of the respective profiles (Fig. 5).

Line L1. Georadar. Starting from the 110 m a.s.l. high saddle, the data show 2 m of colluvium that thins out to the SW, turning to a 0.5-1 m thick deposit (presumably a thin eluvium or a soil). Below it, a stratified, sub-horizontal sequence is visible. This scanty deposit stretches uniformly for 40 m, up to the little ledge shown by an arrow in Fig. 6, which overlies 2-3 m thick top deposits.

### Geomorphological Investigations

Field geomorphological survey, compared with analysis of aerial photographs, suggests that the morphological features of the Cozzo Rotondo hillock could be partially related to anthropogenic interventions. In particular, the saddle separating the hillock from the SE slope, which in turn slo-

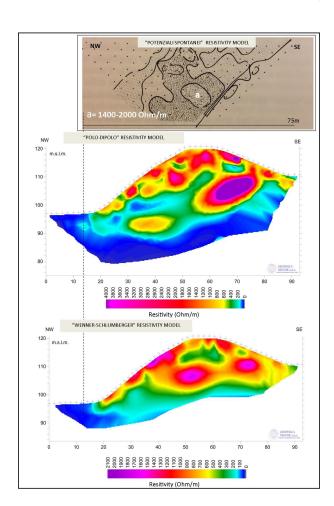


Fig. 4. Geoelectrical tomography obtained by using two different analysis models. At the top geoelectrical data, with the method of spontaneous potentials (after Rizzo, 1986c).

pes down from the adjacent terrace, is anomalous with respect to the surrounding interfluves. The latter are not separated from the fluvial plain by reverse slopes or sub-circular cuts, as in the case of Cozzo Rotondo. Moreover, on the slope next to the hillock there is a debris accumulation in the shape of a terrace that is not stratigraphically related to the outcropping rocks. This deposit, rather lumpy in shape, was clearly modelled by man. It is also characterised by a small bluff, referable either to a gravitational collapse trench or to the trace of an ancient footpath now abandoned. This debris accumulation could therefore be the dug landfill or part of it, resulting from the deepening of the saddle at the foot of the slope and remodelling of the hillock.

A colluvium flow deposit (Dig S3 in Fig. 2) covers the bluff of the SE slope, next to the hillock on the saddle separating it. Here the hillock profile follows a broken line, forming a convexity. The latter is anomalous compared with the opposite slopes; therefore, it is not connected to the lithological sequence and shows a more accentuated angle in its lower part, starting from the vertex of the broken line, which is located at an

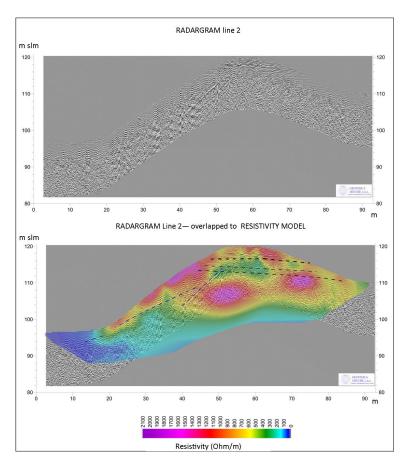


Fig. 5. At the top: georadar profile of the hillock. At the bottom: overlapping of geoelectrical and georadar data and interpretation of some geological contacts. Dashed lines mark the reflections between top conglomerate and whitish sand, which have been surveyed from the top (black lines) and laterally (blue lines; also the reflections from the bottom of the same contacts have been surveyed).

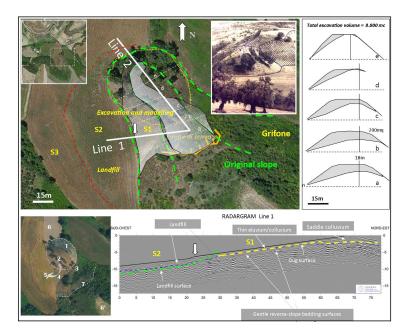


Fig. 6. Top left: Modelling of the digging (volumes are shown in transparency) affecting the original slope (in green), essentially on its SW face, for obtaining the hillock of Grifone or Cozzo Rotondo. Si and S2 are the excavation and landfill surfaces on the W slope, respectively. S3 is the original valley floor not affected by human interventions. In the box, a 3D view shows the flat and terraced surface at the top of the hillock, connected to the slope from which it was excavated. The georadar profile (bottom left) shows the contrast between the digging zone (in yellow) and the deposition zone (in green) of the debris materials. Top right: excavation sections, among which the largest has a surface of some 200 m2, with a total calculated volume of 8,000 m3. Bottom left: Factors on which the elaboration of the construction model was based. 1. Partial distribution of the ancient soils on the relief. 2. Recent and thin soils. 3. Saddle with ancient colluvium, deposited after the 8th century BCE. 4. Area with no deposits, notwithstanding the overlying feeding zone 2, and lacking logical links with zones 3 and 5, where deposits are thicker. 5. Zone with morphological features and layers showing a possible landfill. 6. Valley floor ascribable to the early Holocene. 6'. Terrace from the mid-upper Pleistocene, showing that the cutting of the Grifone valley (from 6' to 6) took place between the mid-upper Pleistocene and the early Holocene. 7. The natural slope, which has an elongated, irregular morphology sloping down from the terrace to the saddle of point 3 and interrupts the regular roundness of the terrace slopes (see box at top left), is in strong contrast with the hillock slopes, which on the contrary are regularly rounded.

altitude of about 118 m a.s.l. We think that this more pronounced acclivity characterises the stretch where excavations were carried out.

It should be noticed that the connection between the hillock and the valley floor to the SW is characterised by two gently inclined surfaces, bounded by a small scarp. The first surface (S1 in Figs. 6 and 7), that is the higher one, which departs from the afore mentioned saddle at 110 m a.s.l., has a slightly more accentuated inclination (about 8 degrees) and a triangular shape, which links the hillock with the bluff of the SE terrace. It corresponds to the area that was denudated by ancient excavations and was subsequently covered by extremely thin eluvium-colluvium deposits. Immediately under these deposits, the

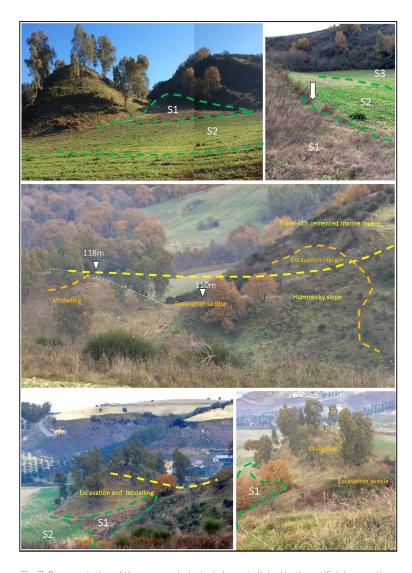


Fig. 7. Representation of the geomorphological elements linked to the artificial excavation of Cozzo Rotondo. S1, S2 and S3 as in Fig. 6. The arrow in the box at top right shows the bluff from S1 to S2. The yellow line in the central picture shows the zone where the hill and the terrace slope are linked together, starting from the vertex of the broken line of the concave profile (elevation 118 m a.s.l.). Ochre colour shows the digging and modelling zones.

stratified sedimentary sequences crop out, in which one can appreciate the reverse-slope contact surfaces in the georadar profile of Line 1 (Fig. 6). The second surface (S2) has a lower inclination (3–5° degrees) and in the aerial photographs appears as marked by a slightly different colour compared with the valley floor deposits. The latter are in fact richer in clay, showing a grey-blackish colour at the surface (S3). A little ledge (Fig. 6) marks the boundary from S1 to S2 at 98 m a.s.l.

The anthropogenic origin of this excavation at 110 m a.s.l., which formed the connection saddle between hillock and terrace, is marked by the contrast between the regular roundness of the hillock and the irregularity of the adjacent slope. Niches representing the visible traces of the dig characterise the latter. They interrupt also the regular continuity typical of the N and E flanks of the terrace and of the other slopes descending gradually to the Grifone valley.

Therefore, we can presume that the hillock is the result of man-made excavation and remodelling activities. By considering the pedological

and geophysical data acquired, it is possible to reconstruct its original morphology, which was characterised by a level and stumpy morphology, in correspondence with its present apex, and by connection slopes. In this way, a natural ramification sloping down from the nearby terrace was formed, as hypothesized in Fig. 6.

### Dating

Absolute dating was carried out on both the charcoal fragments collected in Dig 1 and the mixture ceramics collected in Dig 3. The charcoal collected from the bottom of the moat (US5) was dated by using the radiocarbon method, by means of particle accelerator at the "Iotrace Radiocarbon" laboratory (Toronto, Canada). The test (T-3875) produced a date of 1170±50 BP in 14C conventional years. Once calibrated, the date corresponds to the year 885 CE. This means that the moat surrounding the N margin of the hillock was made before the Early Middle Ages, whereas the 9th century corresponds to the maximum age for the wall foundations.

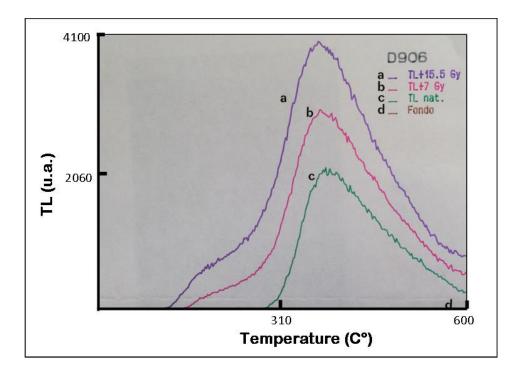


Fig. 8. Results of thermo-luminescence analyses on sample D906.

Thermo-luminescence analysis of the ceramic fragments collected at the base of colluvium (Fig. 8) in Dig 3 was carried out at the Department of Physics of Milan University by Emanuela Sibilia and produced a date (D906) of 2650±194 yrs BP2. Therefore, we have to consider that the colluvium contains pre-existing fragments dating back to 8th-4th century BCE. Then the colluvium deposition was subsequent to this dating. Considering that the fragment were found at the base of colluvium, we can suppose that the slope cave was slightly antecedent (less than a century?) to the colluvium deposition. To make this concept more clearer, we can imagine that the excavation of the saddle took place on 4th century BCE, in order to make a cenotaph for the Molossum death. After not very time, above the saddle beginning the deposition of a colluvium, containing to its base some of the abundant ceramic fragments (pre-existing and dated back to 4th-8th century BCE) lying at that time on the above slope. In fact we do not know how much the incision that formed the saddle is subsequent to the pottery dating and whose effects would be the same, but we can fix limits of a wide time interval, including between the two cited dating.

#### Discussion

Geognostic probes, carried out at different times, showed that Cozzo Rotondo is made up of a planar-stratified regressive sequence in which the lower part is made of uniform sand, becoming gravelly sand and gravel towards the top (last 5 m). This sedimentary sequence is similar to the deposits of the adjacent slope, where a thin, fossiliferous, Pecten-rich, carbonate conglomerate is found. Probably, a thin layer of breccias (no more than 1 m, Fig. 3), cropping out just at the top of the hill, was destructured by anthropogenic activity. The natural earth structure of the hill is in strong contrast with its morpho-

The sample was dated by means of the "fine-grain" technique (Zimmermann, 1971). The material shows a high natural TL signal, good sensitivity to artificial irradiation and linear behaviour in the thermo-luminescence accumulation with the dose, as simplified by the deducible curves. Tests carried out for "fading" control (emptying of the TL traps in the 35 to 55 C zone. These good characteristics allowed the total dose, D, to be assessed with high precision (3% circa). The assessment of the annual dose, d, was carried out by measuring total alpha activity (contribution of uranium and thorium) and by means of flame photometry chemical analyses (contribution of potassium), which were performed on both ceramics and excavation soil. As regards the humidity of the sample, a water content corresponding to 75% of the saturation content was utilised for data elaboration. An age of 2650±194 yrs BP was obtained, thus confirming with high precision the proposal of dating the excavation to the 7th century BCE (after Emanuela Sibilia).

logy, because no morphogenetic factors, such as faulting or fluvial channels, would explain its peculiar shape. A consistent set of morphological data clearly suggests that Cozzo Rotondo could be partially related to anthropogenic modelling of a natural slope. In fact, the saddle that separates the hillock from the terrace at the back cannot be referred to the geological processes affecting the study area.

Besides, its structural homogeneity is in contrast with the distribution of soils along its slopes, which are clearly missing at the top of the hillock and are poorly or not at all developed on the S and SW slopes; whereas they are properly developed and mature, on the N and NE slopes, and especially at the foot of the bluff. In some places, soils pass to the in place-sands without discontinuity, denoting a prevalently carving work. The presence of thick, brown-reddish cambic soil horizons on the northern slope of the hillock shows that this relief has been stable for a very long time (millennia?). The slope of the saddle, which in some points goes up towards the opposite terrace, is covered by ancient colluvium with a calcic horizon at its base and fragments of protohistoric ceramics. Worthy of note is the fact that the deep soils marking the base of the hill are almost absent on the nearest flat depression, due to strong erosion. The georadar profile 1 was performed on the hillock's SW slope (area S1 on Figs. 6 and 7) and confirmed a possible local excavation.

Considering the dating of the potsherds, which were laid into the Dig number 3 but were made earlier on, we think that the excavation of the hillock was more recent, presumably going back to no so far historical times. The dating of the excavation, dating by little fragments of probable pot sherds, indicates a period successive to the 7th century BCE, thus confirming its anthropogenic origin. Indeed, based on the general geological knowledge of this area, the top terraces are ascribable to the Middle Pleistocene and the incisions that affected them, up to the altitude of the River Crati, were probably formed in the Mid-Pleistocene to the Holocene, when the catchment of the River Crati was defined (Colella et al., 1987). This seems to have occurred in a much older period than the time when the processes that modelled the saddle were active. On the other hand, the absence of soil along the sloping areas and in the niches characterise the morphological irregularity of the slope, which obviously underwent a more recent morphogenesis.

Georadar and geoelectrical profiles along line 2 seem to indicate the presence of a discontinuity on the NW slope, between material in place and degraded material. This discontinuity, which is not parallel to the slope surface and is more evident in the top stretch, is of difficult interpretation. This difficulty is due to the particular direction of the discontinuity, which is not sub-parallel to the topographic surface, although it is related to lithology, which locally corresponds to a poorly cohesive soil along the thickness investigated. Considerable inhomogeneous levels cannot be appreciated, especially in the georadar profiles. On the other hand, the effect of sub-horizontal bedding, slightly verging to SW, is quite remarkable in the top part of the hillock and in a series of reflections that georadar data put at 4 to 8 m. The geoelectrical profiles reveal two NW verging, low-resistivity (400-800 Ohm/m) planes. The higher one, which is wetter and confined between sandy breccias and whitish sands, is certainly linked to the stratigraphic boundary. The lower one is confined between whitish sands and yellowish sands. The lack of a good lateral continuity determines the typical "blotched" images that can be seen on geoelectrical profiles.

The moat revealed by Dig 1b (Fig. 2) on the NE slope is not present on the georadar profiles along the axis of the hillock. Perhaps it was in continuity with the surface moat that surrounds its northern side –for a short length– up to the saddle. In fact, considering its modest development in the general morphological framework, its function as a defence trench should be excluded. Similarly, the hillock does not seem to have had entrenchment purposes.

According to the official opinion of several archaeologists, it looks indeed like a man-made burial mound and, considering its dimensions, a large and special one as well. The archaeologists have said

that it is without doubt an impressive and remarkable tumulus, made with great accuracy and set in harmony with the surrounding environment, which recalls a "Greek memorial garden", probably a cenotaph (Rizzo, 1986b,c). In fact, its geometrical settings and orientation features are in agreement with many tumuli of Eastern and Central Europe, where cenotaphs have often been found (Stefan, 2011).

In fact, regarding the dimension and the structure of tumuli in Southern Italy, information is very scarce. There were small tumuli on the top of the Bronze Age and Iron Age tombs as in Altamura. Similar tumuli existed on the top of other indigenous tombs for example in Arpi, Bitonto, Ferrandina, Gravina, Ordona/Herdonia, Pisticci/San Leonardo, Craco, Santa Maria d'Anglona, and Monate Sannace. They have a diameter of 4.50-9 m or in the case of Altamura 9-12 m. The tumuli of San Magno, 26 km away from Gravina, near Castel del Monte, have a diameter of 10 m. Exceptional are tumuli-graveyards of several tumulus-tombs: near Murgia di Bitonto 50 tumuli were located in two clusters near a village of huts (Jatta, 1914). The only large tumuli found are the so-called "specchie". There are circa twenty known specchie in Apulia but just five are very large. Three of them are in Ceglie Messapiaca, Sentina near Cavallino and Specchia dei Mori near Martano. Others are near Pacuseddu, Ficazzano I/ II, in the town La Rinedda, in Campisano, in Cisterna, in the four towns Lenze, Furcedde, Petruse and Lanzicedde, and near De Giorgi I/II, Maliano bei Manduria, Conversano. Two more small specchie are near Lecce, Vanze and Acquarica di Lecce. It is not certain that all the specchie were tombs. With an eye on their position in the landscape, it seems that some of these tumuli were observation points or outlook towers (purposes that are not compatible to the Griphon hillock). They were built with unworked rubble stone or river pebbles. Near Conversano, beside the street in the direction of Putignano, near Torre Castiglione in the town Madonna dei Tetti, the warrior grave "Specchia Accolti" of the 6th century BCE was excavated. On top of the grave there was a 32 m diameter tumulus with two steps, which today is 5 m high. There are influences from Epirus in Apulia but just in the 4th century BCE. The tumuli of the Bronze and Iron Age are influenced by the tumuli in Picenum and Illyricum (Albania). All this information was given by Burkhardt (Burkhardt, 2010 and 2012). Burial tumuli were reported and studied in the lower Crati valley (Macchiabate Necropolis, in the municipality of Francavilla Marittima), starting from the past century (Zancani Montuoro, 1966). On the other hand, Illyrian tumuli – the biggest of which was about 8 m high – were located in the nearby Thurium.

Little tumuli in the territory of Bisignano (Pantanelle and Varano localities) were described by Pagano (1857). They bear witness to the presence of a local Orphic culture (Comparetti, 1910). Moreover, historical documents about Bisignano (Pagano, 1857; Curia, 1985) report the demise of military leaders belonging to peoples that made use of Orphic rites.

Therefore, there are no similarities in shape and constitution between all the above described tumuli and the large tumulus in Bisignano, near Cosenza. The latter is like the tumuli in Macedonia in Greece, as hypothesised by Velkov and Naidenova (1993). The difference that makes this peculiar construction "unique" consists in its almost totally natural earth constitution: a sort of carving and modelling of a natural slope. It is a unique phenomenon in Apulia and probably in Europe. Tumuli made by modelling of a natural hill are reported in Eurasia (e.g the tumulus of Gaozong and Wu Zeitan Chinese emperors).

Considering that modelling had to be minimal, we hypothesized a compatible natural morphology of the previous natural slope, in order to acquire data on the possible excavated volume. In particular, the reconstruction of the origin of the excavation took into account the following elements: i) nature and distribution of the soils on the hillock; ii) irregular, full of niches morphology of the slope that from the saddle goes up towards a terrace; iii) morphology of the slope joining the base of the hillock to the valley floor to the SW, along the georadar orientation of line 1, and sedimentological data surveyed by the georadar; iv) flexure point of the hillock SE slope, which delineates an anomalous, convex-shaped profile due to interfluve incision.

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The kind of modelling hypothesized is best justified by comparison with similar morphological situations. The total earth volume excavated was calculated as 8,000 m3. In agreement with geomorphological data and the radargram of line 1, the material excavated was evenly distributed over a surface of some 0.5 ha, with a thickness of 1.5-2 m. Therefore, the volumes of the excavated material and of the landfill are fully compatible. The result of such "carving" work was a hillock 22 m high on the NW side and 10 m on the SE side, with an average base width of some 60-70 m and a volume of 15,000 m3. Therefore, owing to these geometrical features, the volume of excavation equals about 1/2 the volume of the hillock. Probably this was a way to obtain a peculiar impressive earth body while working less than when using accumulated material to make something monumental.

#### Conclusions

Cozzo Rotondo is a hillock made up of a natural sedimentary sequence of planar-stratified Pleistocene littoral deposits. In contrast with its geological constitution, and on the basis of geomorphological and morphogenetic features, sustained by all the other data collected, the shape of the hillock was considerably remodelled on its southern slope. The natural threshold that united it to the interfluve was excavated up to some 5–7 m in depth and the landfill material was artificially scattered over the slope underlying it. Based on the dating analyses carried out, this tumulus might have been built after the 7th–8th century BCE, most likely near 4th century BCE.

On base of results obtained from this research Cozzo Rotondo (or Griphon Hillock) at Bisignano, only case in Europe, is an impressive artificial mound obtained by a slope carving, closely recalling an imposing funerary tumulus, a mausoleum. Besides, the collected data indicate as reliable the hypothesis, made by several European archaeologists that this hillock could be the cenotaph of Alexander Molossus, who died near Cosenza in the second half of the 4th century BCE, and whose body was almost totally destroyed.

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