*i*Journals: International Journal of Social Relevance & Concern (IJSRC)
ISSN-2347-9698
Volume 10 Issue 4 April 2022

LAKE OF NEMI, ROME, ITALY - ARCHAEOLOGICAL RESEARCH NEAR AN ANCIENT ROMAN-PERIOD DOCK COVERED BY A LANDSLIDE

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ABSTRACT

In the past, a large area of the south wall of Lake Nemi (Rome, Italy) collapsed, settling down and towards the lake mirror, where rock structures built in Roman times and forming part of a quay were positioned ships could be docked. The purpose of this study was to document the extent of this landslide, especially below the landslide, to try to understand if the landslide itself could have incorporated other constructs made by man and present at ground level at the time. preceding the collapse.

Keywords: Ancient landslide, Roman quay, Nemi Lake, Archeology, Research, Roman Empire, Emperor Caligula.

1.0 – INTRODUCTION

That Lake Nemi conserves priceless treasures is something that has been documented for years, in the Fascist era, two extremely large Roman ships were found and then lost at the end of the Second World War (**Fig. 4**). Together with these two incredible engineering works, Lake of Nemi still preserves, in some points, historical evidence of our ancient past concerning ancient quays and hydraulic works unique in the world. The ancient ships, more similar to real floating temples, date back to I scolo a.C. were built by the emperor Caligula (from 37 to 41 a.C.).

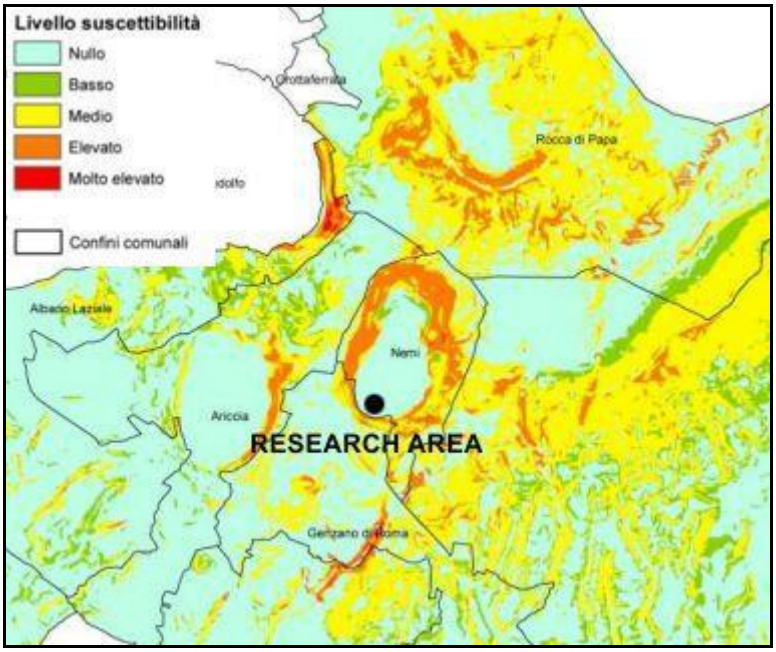
On the southern side of the lake, part of what was once the supporting structure of a bench used perhaps for mooring ships is still visible today (**Fig. 2** and **Fig. 3**). In 1930, to bring the two Roman ships to light, the lake mirror of Lake Nemi was almost completely drained, allowing the recovery of the ships, which were then housed in a structure built for the occasion and which still exists today. which later became the "Museum of the Roman ships of Nemi" [**3**].

The research point is the one visible in **Fig. 1**, where it is also possible to observe the presence of palisades found during the works carried out at Lake of Nemi (RM), in the pre-war period from 1928 to 1932, by the Mussolini government.

The presence of these palisate identifies the place where the exploration studies were carried out by the Arco di Diana APS Association. (**Fig. 1**) [**1**]. At this point, ancient palisades from the Roman era are still visible today, whose position has been moved by the fall of the rock detached from the overlying wall (caldera crater), which has partly spread everything in the direction of the lake. of the collapse. Part of the landslide is still visible today on the shore, characterized by huge blocks of stone, while the rest of the material has deposited below

the water level. At this point, precisely to understand its extension on 19 July 2021, the Arco di Diana APS Association performed specific and technical underwater activities, to outline the limits of this landslide, allowing in the future to be able to understand which the actual quantity of the rock mass detached from the wall.

According to some studies, it is highlighted that the steep slopes of Lake of Nemi are very susceptible to collapse and are currently affected by recent investigations, the danger of collapse and landslides is still present today near the Nemorense street, along the east side of the lake, which is very high. This means that in the past the south wall of the lake, and in general the entire slope in this direction, was subject to landslides, the last of which is still visible today in the logo (documented in this study) [**9**].



Scheme 1 – Danger of collapse and landslides calculated for the Lake of Nemi (Rome, Italy). It is clear that this lake is the one at greatest risk of landslides and collapses in the entire area of the Laziale Volcano. Credits: Università Degli Studi Di Padova [9].

The **Scheme 1** gives an idea of how the Lake of Nemi (Rome, Italy) is the volcanic lake most at risk of landslides and collapses, of the entire ecosystem of the Laziale Volcano. In red the associated danger is at the highest level, and this explains how the rocky wall explored by the Arco di Diana APS Association is a real example of this danger, not only recent but also relative to the past [**9**].

1.2 - Historical Data - Roman Times

The lake was an appreciated place of entertainment and vacation of the ancient Romans. Since ancient times, Lake Nemi has been the subject of a legend concerning two fabulous ships of gigantic size, built in roman times, rich in splendor and perhaps containing treasures, which would have been buried on the bottom of the lake for mysterious reasons. This legend probably began to circulate since the 1st century a.C., and then throughout the Middle Ages, occasionally credited by the occasional discovery of strange finds by the fishermen of the lake. These rumors did indeed have a foundation of truth.

The two ships, 70 meters long and more than 25 wide, were built by the emperor Caligula, in honor of the Egyptian goddess Isis and the local goddess Diana, patron of the hunt.

The result of advanced engineering and beautifully decorated, Caligula used them as floating palaces in which to live or stop on the lake, or with which to simulate naval battles. But following his death in 41 a.C., the Senate of Rome (of which the emperor had been a bitter political opponent) had all the

works of Caligula destroyed, including the ships of Nemi, which were sunk. at the bottom of the lake. Since then, the history of the ships, combined with the memory of their magnificence, soon became a legend.

The Lake of Nemi, therefore, was frequented by very ancient times.

In ancient times, the lake, together with the wood, which extended towards the S-W as far as the Via Appia, was part of the Latin city of Aricia and was therefore called Nemus Aricinum or Nemus Dianae, hence the modern name of Nemi. There was a famous sanctuary dedicated to the goddess of hunting, moonlight and reborn life to which all the populations of Lazio flocked. The cult of her was regulated by a very singular rite that was linked to the human sacrifices that were celebrated in the feasts of Artemis in Sparta, in ancient times. The priest of the Goddess (rex nemorensis) was a fugitive slave, who obtained the priesthood by killing the previous priest in hand-to-hand combat, and had to be replaced in the same way in due course.

The ruins of the temple can still be seen in the locality known as the Garden, a large esplanade cut halfway up by the eastern side; it consisted of an enclosure supported by walls with various chapels and an altar in the center [**11**] [**12**] [**13**].

The traces of an ancient quay dating back to the Roman period or in any case ancient, were documented at the beginning of the last century, during the emptying of Lake Nemi, in order to be able to collect the two Roman ships.

In this context, the presence of a large amount of material present on the shores of Lake Nemi was documented, including the presence of wooden palisades, to protect the shores (**Fig. 3**), also in the area where the Arco di Diana Association carried out the research, namely in the southern part of the lake, just below the Genzano di Roma Cemetery, Rome, Italy. This testimony comes from Prof. L. Giammiti of the Archaeological Superintendence of Rome (**Fig. 4**), commissioned since 1929 by Prof. Cultrera to assist in the work of clearing the Lake of Nemi, and here he carried out accurate surveys of this palisade, a palisade that is still partially visible today (**Fig. 12**) [**14**].

1.3 - Past Seismic Events

What could have determined, in the past, the large landslide on the southern side of the Lake of Nemi? To understand this, we must consider, for example, the seismic events that occurred from about 500 onwards. The following is a chronicle of the ancient earthquakes that occurred in the area of the Province of Rome, ie in central Italy.

VI CENTURY

442 or 443

Rome was hit by an earthquake which caused statues and the 'new porticoes' to collapse, perhaps to be identified with the two parts of the portico of the Teatro di Pompeo. The responsibility for a collapse in the main nave of the Basilica of San Paolo fuori le mura was also attributed to this earthquake. The Colosseum and the Roman Amphitheater were also damaged.

476

Another earthquake in Rome, with partial destruction of the city. Apparently the tremors lasted for 40 days.

IX CENTURY

30 April 801

Epicenter between Spoleto and Perugia, this earthquake was disastrous. In Rome the roofs of the church of San Paolo Apostolo collapsed. Even the church of Santa Petronilla seems to have fallen as a result of this earthquake, but there is no certainty whether the damage in Rome was caused by the same earthquake or by a different one.

847

Earthquake in Rome, caused the collapse of a part of the Colosseum.

849

New shock in Rome, probably caused the fall of the Obelisk of Montecitorio.

XI CENTURY

1005

Earthquake with its epicenter in the Comino Valley (Frusinate), on the VII-VIII Mercalli scale.

XIII CENTURY

30 April 1279

Earthquake in the Umbria-Marche Apennines, with serious damage between Cagli, Fabriano, Nocera Umbra and Foligno. A few hours later another earthquake in the Tuscan-Emilian Apennine area caused damage and numerous deaths.

XIV CENTURY

3 December 1315

Earthquake in L'Aquila and Sulmona, of the 5 / 5.5 degree Richter scale. It was preceded by a slight seismic swarm which began on February 1st of the same year. There were no victims, but many buildings in L'Aquila were damaged or unusable, such as the church of San Francesco. The tremors lasted for 4 weeks; the population lived outdoors in makeshift sheds until 1316.

1 December 1328

Earthquake in Norcia (Umbria), many dead.

9 September 1349

Epicenter on the Abruzzo Apennines near L'Aquila, 6.3 Richter scale earthquake. All the city walls were pulled out and various city gates collapsed. Serious damage and collapses throughout the L'Aquila area, Lazio and Molise, but also in the Marche. Complete collapse of the town of Pescasseroli. Alvito castle destroyed; considerable damage also to the Abbey of San Clemente a Casauria. For a short time the most affected cities were semi-uninhabited. Slight damage also to Teramo and Atri. In total, over 1000 victims were recorded.

December 25th 1352 and New Year's Eve 1353

Two tremors between Umbria and Marche, respectively of 5.6 and 5.8 Richter scale, caused part of the buildings and walls of Sansepolcro to collapse, causing some victims.

XV CENTURY

2 February 1438

Earthquake in Lazio, with its epicenter on the Alban Hills (5.4 / 5.6 Richter). It was probably the second strongest earthquake produced by the Colli Albani volcano.

April 26, 1458

Epicenter between Umbria and Marche (5.8 Richter scale), with some dead.

November 26, 1461

Earthquake in L'Aquila with a magnitude of 6.4 on the Richter scale. The quake was followed by other less severe tremors in December and January of the following year. Many damages and collapses in L'Aquila city; literally destroyed were the nearby Onna, Poggio Picenze, San Pio delle Camere and Sant'Eusanio Forconese. It was shallow, as it hit a small area of the province.

XVI CENTURY

1506

Earthquake in Abruzzo, in the area of the Frentani Mountains, with serious damage to Ortona where districts were destroyed and hundreds of deaths.

13 June 1542

Epicenter on Mugello, the earthquake caused about 150 victims and ruined much of the castle of Scarperia, as well as other places including Gagliano, San'Agata, Barberino, Bosco ai Frati and Luco.

September 17, 1563

Earthquake in Atri (Abruzzo) around 4 pm The cusp of the facade of the cathedral collapsed, causing some deaths and injuries.

November 5, 1599

Epicenter in Avendita-Cascia (Perugia) grade 5.9 Richter scale. Damage to the town and surrounding areas. Some dead.

XVII CENTURY

7 October 1639

Earthquake in Amatrice (Rieti) of 5.9 degrees Richter; caused many victims.

23 July 1654

Strong earthquake between Lazio and Abruzzo, in the area between the Comino Valley and the Marsica, of 6.1 degrees Richter. Lasting until 12 August, it caused thousands of victims (about 3000), first martyring the towns of Pontecorvo, Roccasessa, Piedimonte S. Germano, Atina, Alvito and then those of Sora, Arpino, Isola del Liri. The chronicles of the time reported that Mount Corvo even split.

10 June 1695

Earthquake between Lazio, Abruzzo and Umbria of 5.9 degrees Richter; especially affected the area of Viterbo and its surroundings. Almost totally destroyed Celano, in the Aquila area. About 200 people died.

XVIII CENTURY

January 14, 1703

Epicenter between Umbria and Marche (6.7 Richter degrees); caused about 6-9 thousand victims. Almost completely destroyed the village of Avendita, in which only 29 inhabitants survived. In Ascoli Piceno and Foligno the earthquake was very intense but did not cause damage.

2 February 1703

Strong earthquake in L'Aquila (6.7 Richter), where the city was almost razed to the ground, with very serious damage to the artistic and architectural heritage of the time. Serious damage also to Paganica; over 6000 were the victims.

November 3, 1706

Epicenter on the Maiella massif (6.6 Richter) in Abruzzo; also caused damage in Molise. Many buildings destroyed in Sulmona, including numerous churches. Over 1000 the dead.

12 May 1730

Earthquake 6.1 degrees Richter in Avendita (Umbria), also felt in the Marche, Lazio and Abruzzo. Over 200 dead, 500 injured.

April 17, 1747

Between Umbria and Marche (IX Mercalli), it caused quite serious collapses and damage; a dead.

July 27, 1751

The city of Gualdo Tadino (PG) was seriously damaged and loses its late medieval characteristics.

6 October 1762

New strong shock in L'Aquila (5.9 Richter) with about 500 deaths; the town of Poggio Picenze was almost entirely destroyed.

3 June 1781

Two very strong aftershocks at a distance of 10 minutes on the border between Marche, Umbria and Tuscany. The greatest damage occurred in the area of Piobbico and Cagli.

30 September 1789

Earthquake in Umbria, between Città di Castello and San Sepolcro (5.8 Richter), caused various damages, the collapse of the roofs with many victims (about 500). Seismic sequence of about ten days.

May 26, 1798

Strong earthquake in Siena, at 13.10. Numerous damage to buildings in the city, including the Duomo. Some victims.

July 28, 1799

Intense seismic swarm in the Marche region (5.9 Richter); three shocks of increasing force, around 14, 19 and 23, caused very serious damage in the area between Camerino, Sarnano, Cessapalombo and San Ginesio. About 100 victims. Cessapalombo was almost destroyed; the tremors lasted until September, of gradually lesser intensity.

XIX CENTURY

August 26, 1806

The most violent earthquake produced by the Colli Albani Volcano (5.8 Richter). It had the maximum effects, causing many deaths and injuries, in the towns of Rocca di Papa, Velletri, Genzano and serious damage in other 14 neighboring towns (Nemi, Frascati, Lanuvio, Zagarolo ...). Entire neighborhoods, palaces, churches, cathedrals and convents collapsed. Damage also in Rome. In Nemi there was the temporary appearance of a small sulphurous basin; an unusual and great agitation of the waters of the sea south of Rome was also noted, as well as a lowering of the water level of the Tiber.

1 June 1829

New earthquake on the Alban Hills (4.7 Richter), preceded by a swarm that started on May 22nd. The tremors lasted until July. Serious damage with damaged houses and discreet collapses in Albano Laziale and Marino. The abandonment of homes already with the first shocks of May prevented injuries and victims; some of the tremors produced rumble, the smell of sulfur, emanations of carbonic acid gas and other dangerous vapors from the subsoil.

13 January 1832

5.1 Richter earthquake in the Umbria-Marche area, with 40-50 victims.

22 August 1859

Earthquake in Umbria, with 101 dead. More serious damage in Norcia, where the Town Hall, the Roman Gate and the bell tower of the Cathedral collapsed. Approximately 76 houses were razed to the ground.

10 September 1881

Epicenter in the eastern foothills of the Maiella (VIII Mercalli). The main localities involved were Orsogna, Gaurdiagrele, Ortona and Lanciano. Ten dead.

June 26, 1899

Earthquake in Tuscany (5.1 Richter), it affected a large part of the province of Prato, the most intense of the city during its history. Partial damage to residential and monumental buildings.

July 19 1899

Third most violent earthquake on the Alban Hills (5.2 Richter), with new collapses and serious injuries. In Rome there were partial collapses and injuries, even in important monuments, such as the church of the Gesù, San Giovanni in Laterano, Palazzo Chigi, Palazzo Sciarra, the Aurelian walls. There were no deaths but many wounded in Rome, Frascati, Monte Compatri and Albano Laziale. The shock caused emanations of carbon dioxide and the agitation of the volcanic lake of Albano.

These are the most important seismic events that occurred in the past, and which could have caused the collapse of the south wall of the Lake of Nemi, a collapse that probably occurred a few centuries ago and to date not documented by any available document [**10**].

2.0 – METHODS

On July 19, 2021, the divers of the Arco di Diana APS Association reached the lake to place floating buoys, anchored to the bottom, right on the edge of the landslide perimeter.

By applying ropes, it was therefore possible to measure the depth of the various points where the buoys were placed, as well as to find the GPS (Global Positioning System) position of the buoys on the surface by drone. The positioning of the buoys took at least 1.5 hours of work, thanks to the assistance of two small boats.

At the end of the positioning of the buoys, the GPS (Global Positioning System) position of each buoy was then found, taking about 12 minutes of flight. The entire process of positioning and removing the buoys lasted from 08:35 to 12:45 approximately (4 hours and 15 minutes). At the end of the technical procedure it was then possible to screen the collected data, such as depth and GPS position (Global Positioning System) of the buoys and insert these data on a three-dimensional model, to understand and understand what was the real extent of the collapse, as well as the amplitude of the landslide beyond the margins present in the waters.

The work was very complex, both for the safety of the divers and for the precision of the landslide detection below the water level. This circumstance engaged the divers in two groups, one group positioned on the seabed, while a second group at a superficial depth, such as not to allow depth variations such as to cause danger for the human body, under water pressure.

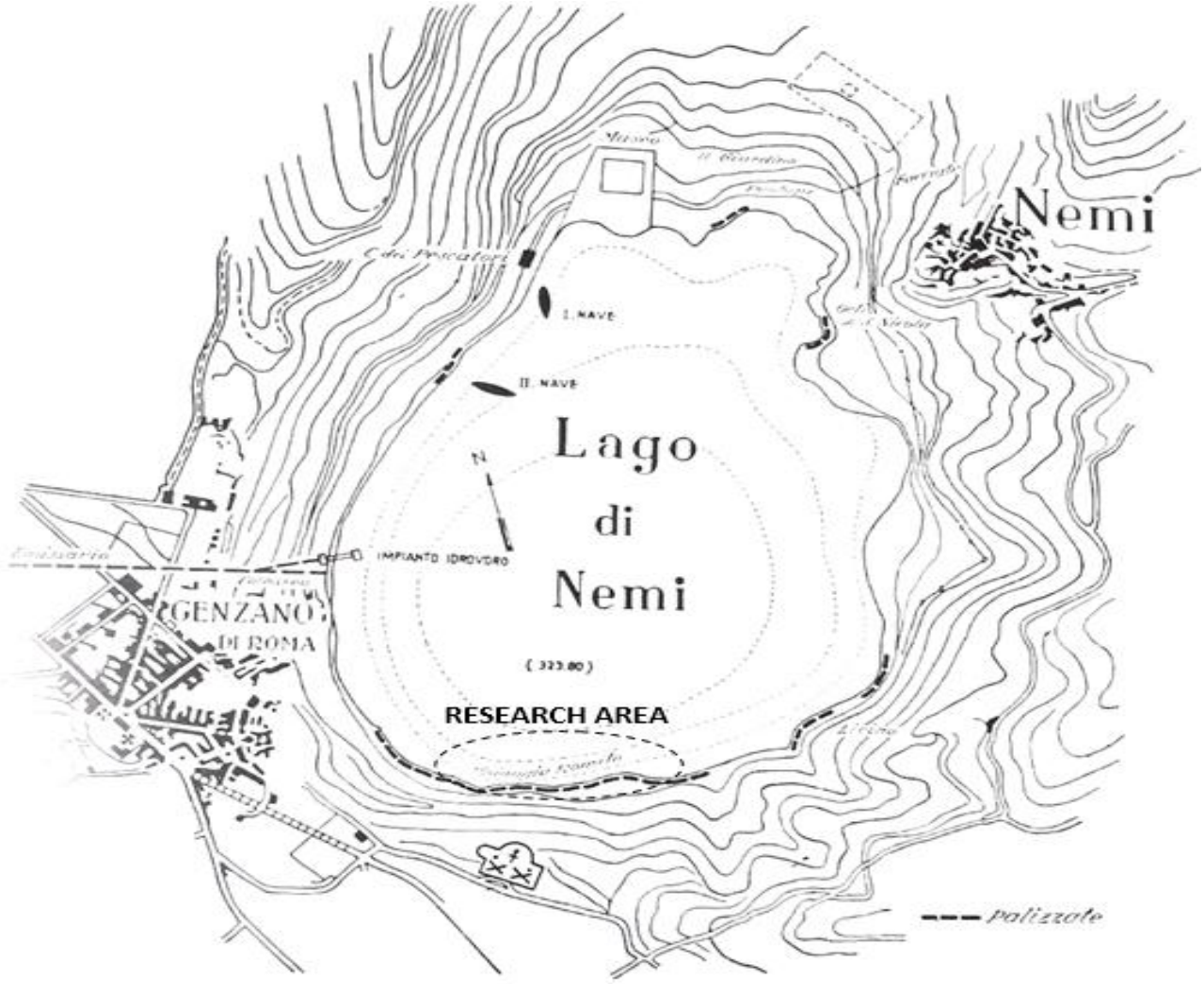


Fig. 1 - Ancient map of Lake Nemi - where the presence of wooden palisades is observed, at the point where the research study by the Arco di Diana APS Association was carried out. Credits: Guido Ucelli [14].

Nevertheless, the dives of the divers were limited to one, lasting about 1.5 hours.

The water present on the bottom was quite tobita, and cold (around 10° C), this fact did not allow an optimal approach, especially at a depth greater than 9 meters. The suspended dust has determined a restriction of vision, and therefore the impossibility of identifying a greater number of lithic or structural elements (in wood) that are part of the ancient quay of the Roman era.

The movement of the divers on the seabed followed the course of the edge of the landslide, beyond which the bottom of the lake is almost flat.

The presence of square (anthropized) boulders present on the bottom of the lake at the point of exploratory research, led the Arco di Diana APS Association, to subsequently perform (in the near future) further exploratory dives to document the number of these lithic elements and their precise location.

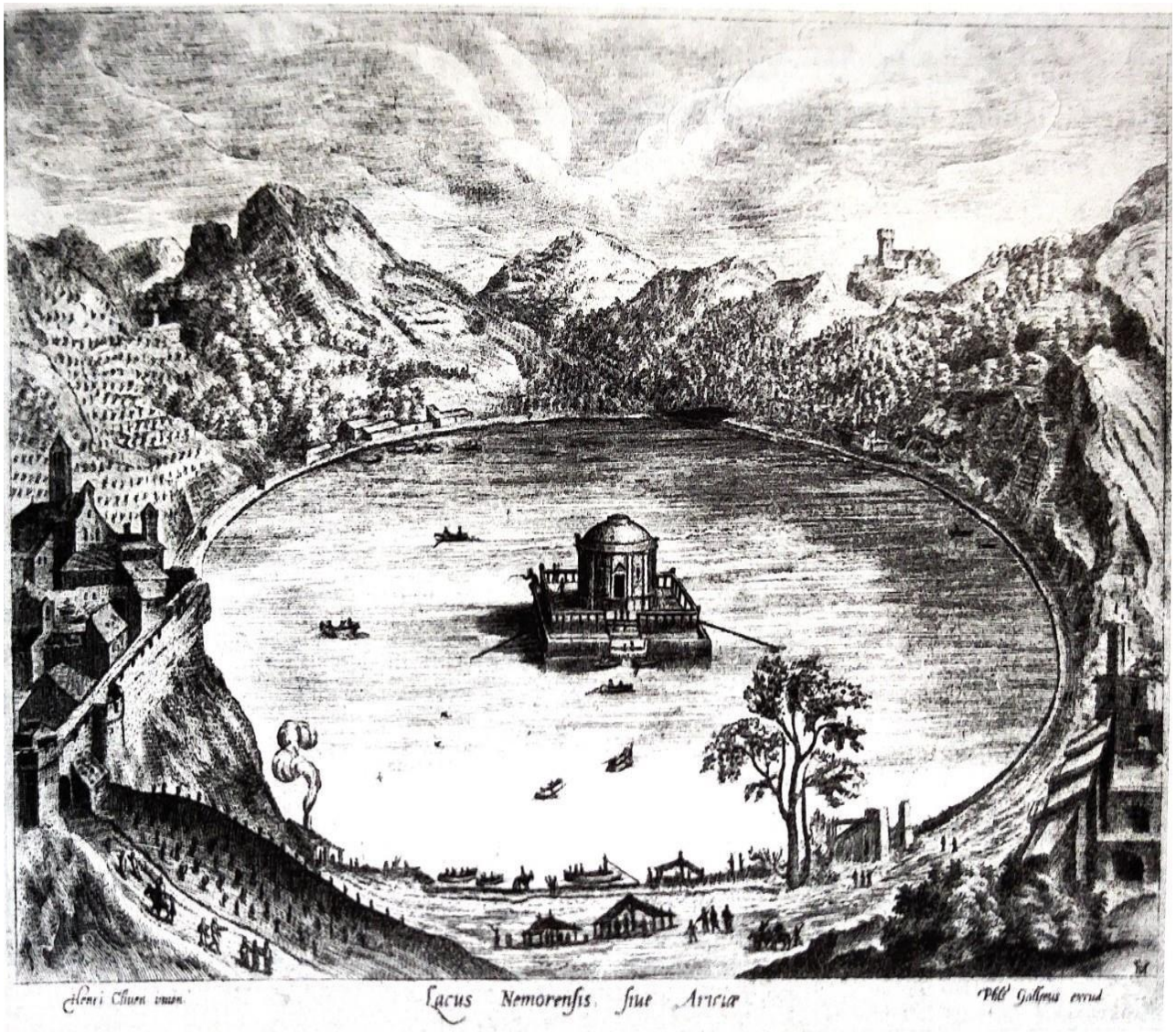


Fig. 2 – Filippo Galli - from a painting by Van Cleef (1520 - 1589), Lake Nemi [14]. You can see (below) the research area where the Arco di Diana Association performed the underwater exploration. It is clear

that an ancient pier once existed at this point, given that the engraving refers to boats present near the shore.

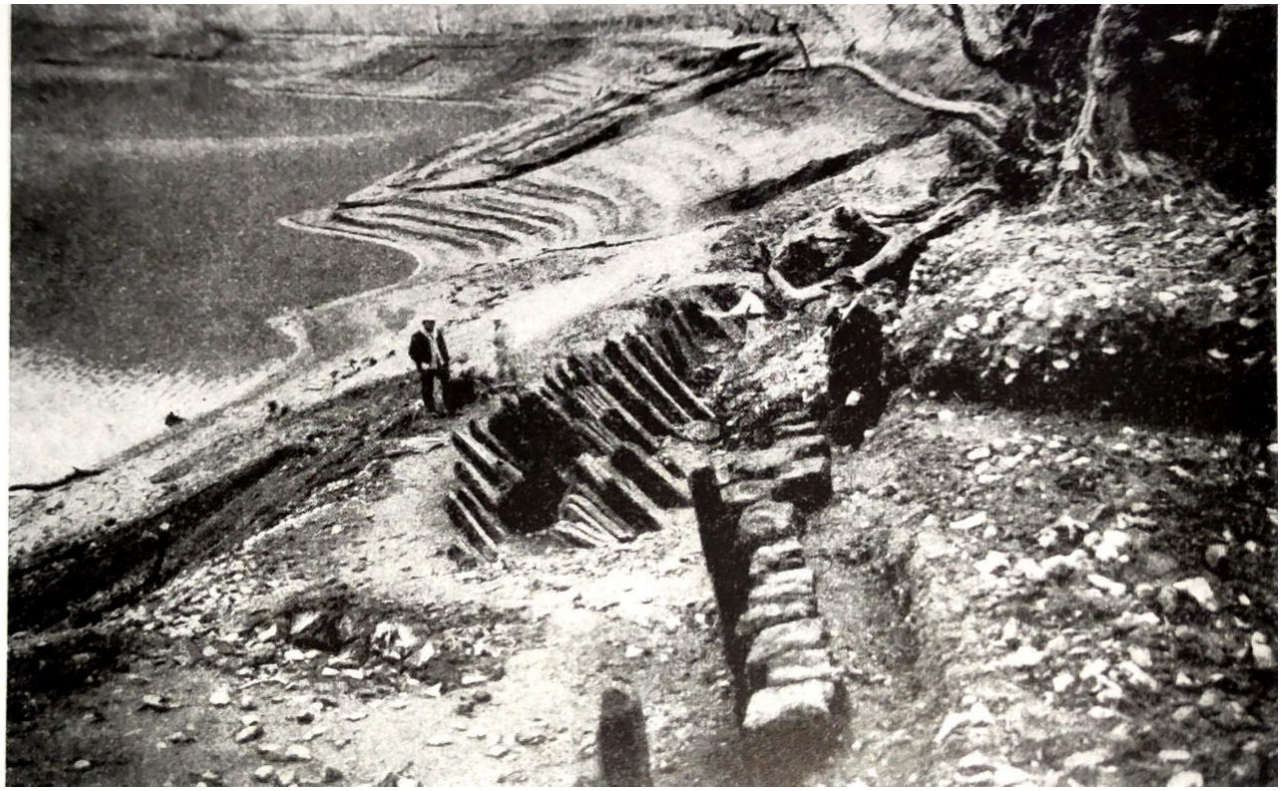


Fig. 3 - Ruins of the quay along the shore of Lake Nemi. They testify how the blocks found also in the research area carried out by the Arco di Diana APS Association refer to squared blocks that in ancient times must have been part of a quay located on the shore of the lake, which was then swept away by the landslide [14].

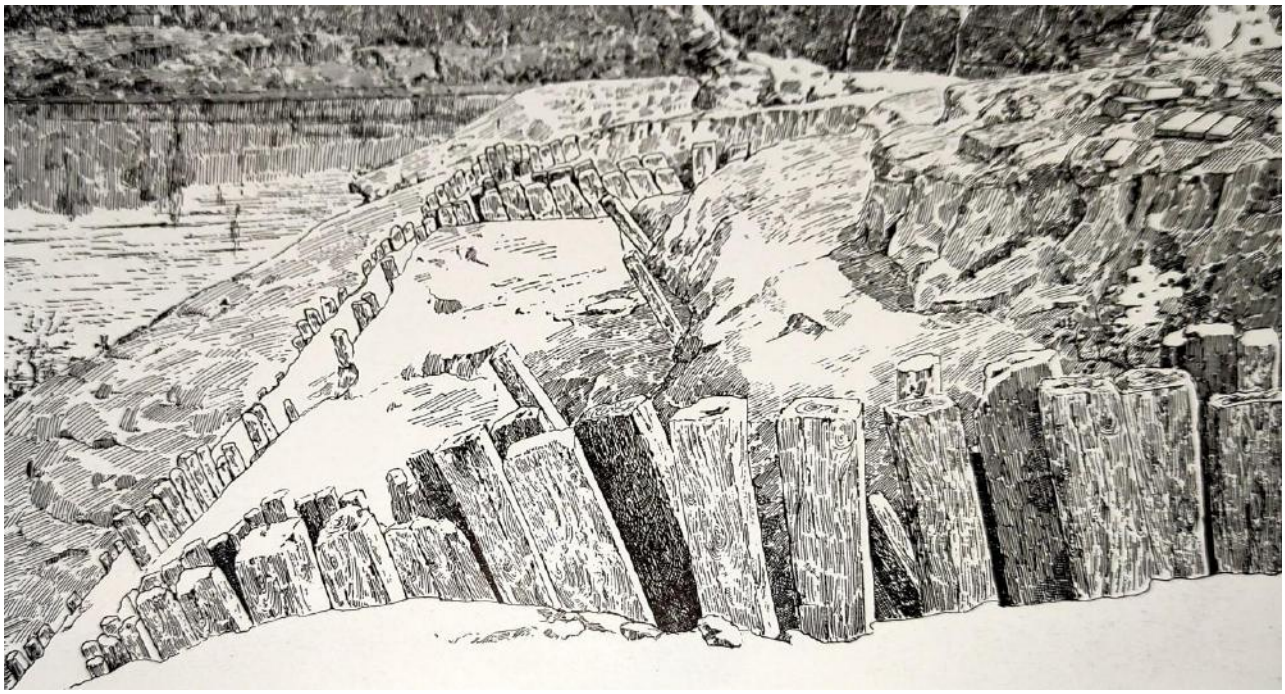


Fig. 4 - L. Giammiti - Remains of a palisade found under the cemetery of Genzano di Roma, Rome, Italy. This is the same point where the Arco di Diana APS Association documented the landslide, both on land and under the waters of the lake. This testifies that the point where the searches were carried out was characterized by an ancient quay [14].

2.1 DATA ANALYSIS

The location of the data taken from the bottom of the lake and by means of aerial shots with the aid of the drone, made it possible to create a map of the extent of the landslide in the water. The first data are those relating to the depth measured on the bottom, in relation to the position of each floating buoy, a depth which is summarized in the following two graphs (**Fig. 5** and **Fig. 6**):

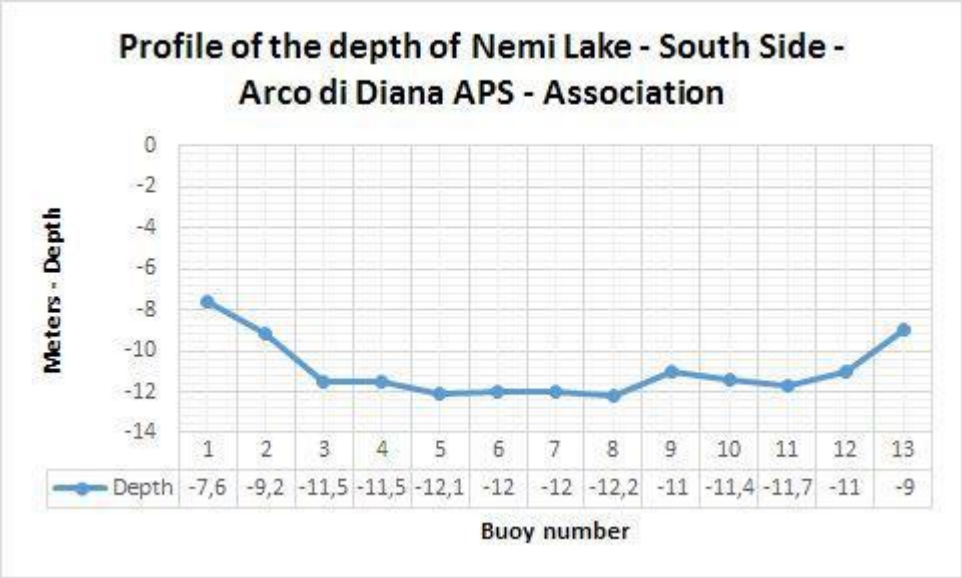


Fig. 5 – Graph relating to the depth of the buoys. Credits: Arco di Diana APS.

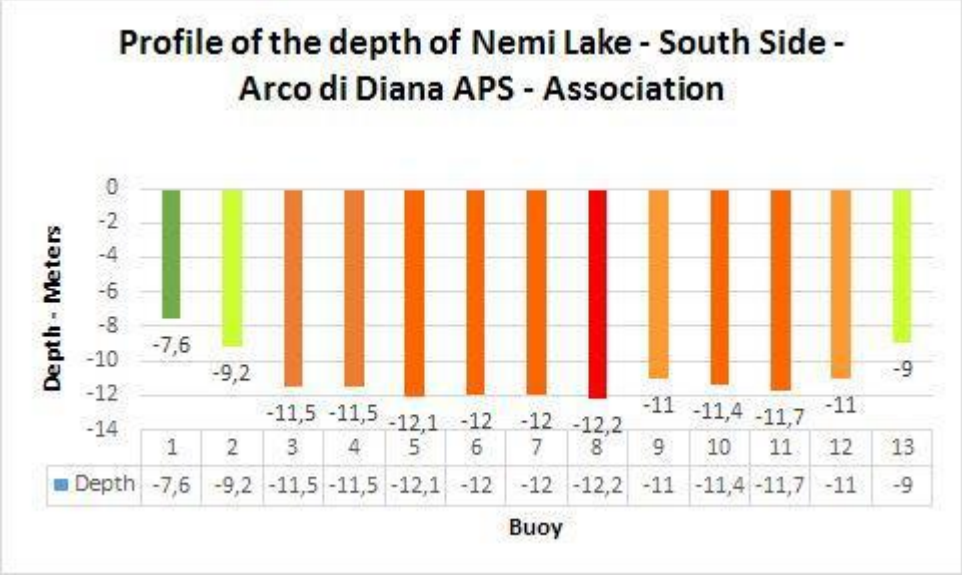


Fig. 6 – Graph relating to the depth of the buoys with colorimetric variation relative to the depth itself. The lowest depth is revealed in green, and then gradually passes to light green, orange and red, where the maximum measured depth is reached. Credits: Arco di Diana APS.

2.2 - RESULTS

The results related to underwater and aerial activities are as follows. The mapping of the landslide below the water level made it possible to perform several important calculations to understand the actual extent of the collapse and its ability to move the soil (plasticity), as well as the anthropogenic elements present on it. .

The three-dimensional data were acquired thanks to Google Earth Pro, in which the GPS (Global Positioning System) markers of the individual buoys were inserted. The result is the one visible in the **Fig. 7**. In **Fig. 8**, on the other hand, the perimeter of the buoys and the relative proximity (on land) of natural rocky elements, detached from the rocky ridge, are visible (**Fig. 16**, **17**, **18**, **19** and **20**). This indicates that part of the landslide is outside the water and is close to the rock face for hundreds of meters. Some calculations, made possible precisely by the perimeter of the landslide in the water, made it possible to understand the true extent of the collapse, a collapse extended for at least 225 meters and with a width, from buoy 8, of 100 meters with respect to the position of the rock wall (**Fig. 9** and **Fig. 10**).

Fig. 7 - Perimeter of the landslide in the water with floating buoys. Credits: Arco di Diana APS. Credits: Arco di Diana APS - Google Earth Pro.

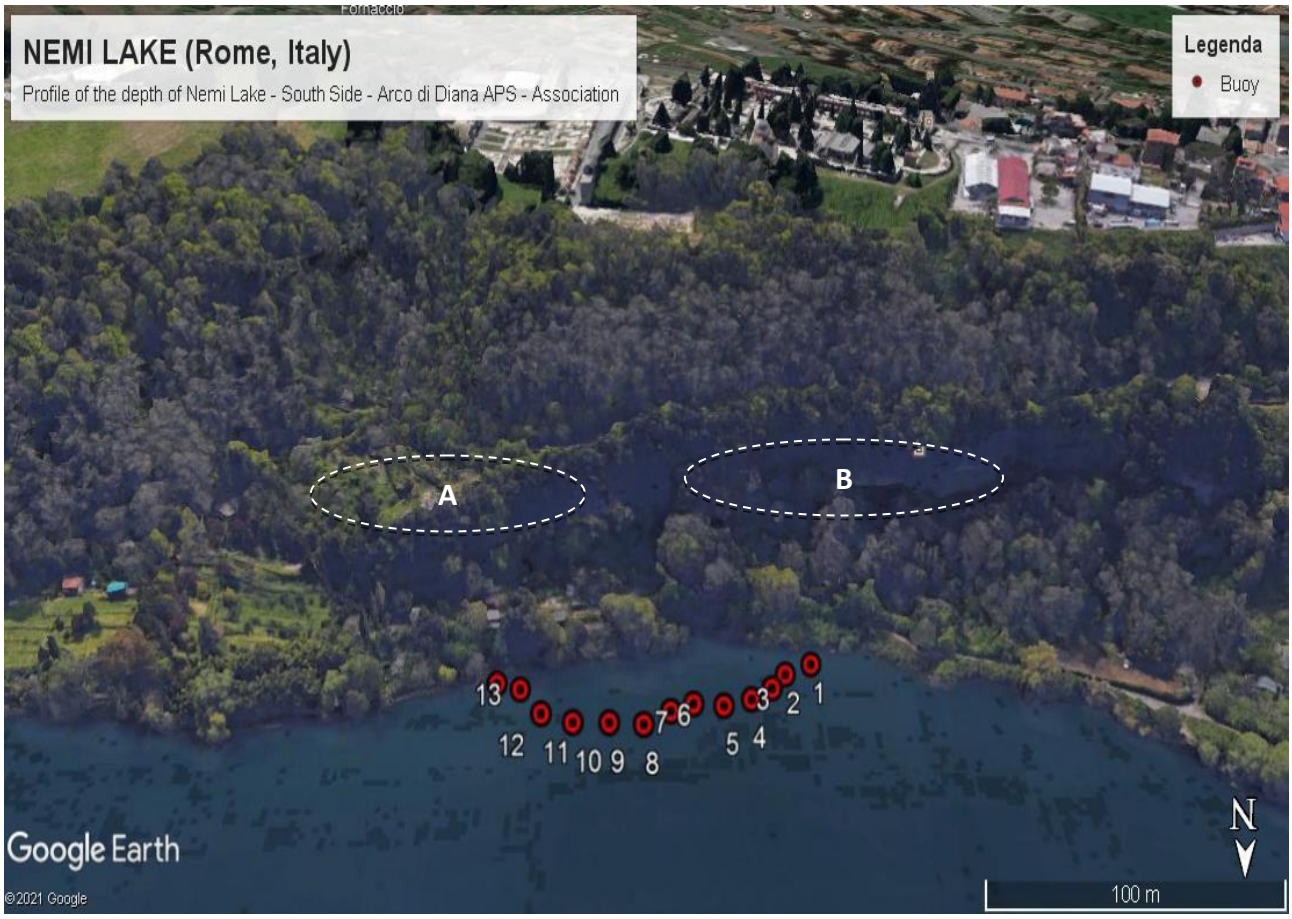


Fig. 8 – Position of the landslide in the water (perimeter), and location of the lithic elements that have fallen and deposited on the ground, beyond the water holes (A and B). Credits: Arco di Diana APS - Google Earth Pro.

This research activity, promoted by the Arco di Diana APS Association, was able to highlight for the first time ever, how the extension of the landslide is half below the water level. At the median point of this measured landslide, the distance from the rocky ridge is 100 meters (approximately near buoy 8), 64 are the meters that instead separate it from buoy n. 13 (east portion), and 81 meters are those that instead separate the limit of the landslide in the water (buoy n.1) from the rocky wall (west portion). By evaluating the contours of this landslide, and observing the number of boulders present and visible out of the water, we can hypothesize an extension of the landslide much larger than that observed in the water, as visible in **Fig. 10**, that is a landslide of 225 meters long and 100 meters wide in the widest part (22.500 m^2).

This denotes that in reality half part of the landslide is underwater, and half outside the lake (at least as regards the area considered).

As for the depth of the points where the floating buoys have been inserted, we can calculate the average depth which is -9.3 meters (up to the perimeter of the landslide in the water), calculating this and considering the amount of material precipitated from the ridge. rock which is deposited in the direction of the lake waters (by gravity), +4 meters above the water surface, it can be deduced that the resulting volume in rock is 151.875 m^3 (**Fig. 5**). The mass of fallen rock has a prismatic shape with a triangular section; how is this volume calculated?

22.500 * (-9.3 + 4) / 2 = Total volume in m^3 (Fig. 11)

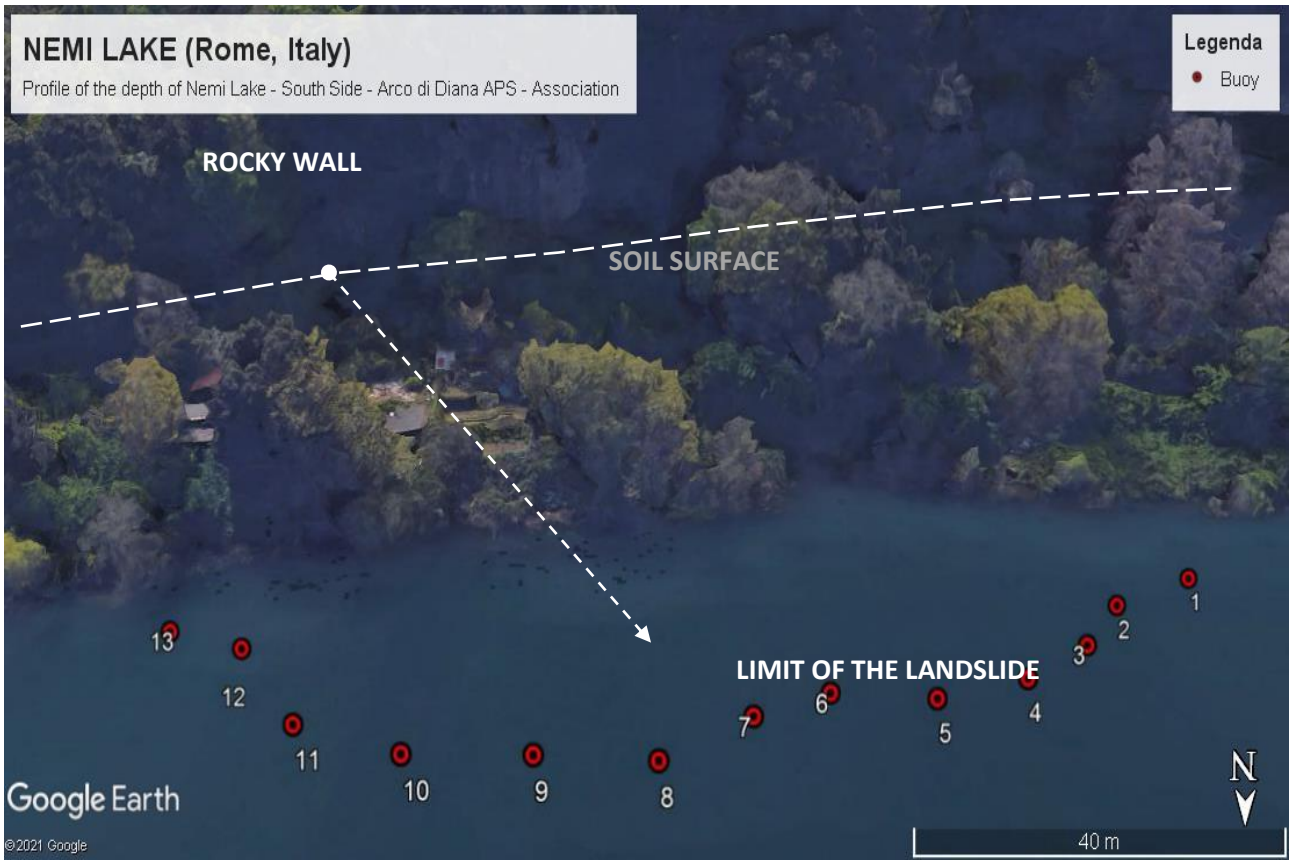


Fig. 9 - Maximum distance of the landslide from the rock face (100 meters). Credits: Arco di Diana APS - Google Earth Pro.

If we consider that the basalt (rock of which the collapsed wall is made up has a weight of 2,900 kg / m^3, we can understand that at least 440.437.500 kg of rock fell from the wall, or 440.437 tons, and this only in the area facing the evaluations made at the point of measurements. In physics and materials science, soil plasticity is the ability of a solid to undergo large irreversible changes in shape in response to applied forces [**4**] [**5**] [6**]** [**7**]. Examples of materials that exhibit plastic behavior are clay and steel when the elasticity limit is exceeded [**8**].

It is hypothesized that such a weight has modified any element present on the ground, whose surface has been subjected to a plastic movement and has deformed [**8**]. The position of some anthropogenic structures from the Roman era, visible today, which are "spread" in a certain direction with respect to the position of the collapsed rocky mound, suggest just this.

The **Fig. 12** shows a series of wooden elements arranged on the shore of Lake Nemi and in the water, just above the ground moved by the landslide. The position of these poles, of very ancient origin, in fact follows the course of the ground (mass), in the direction of its plastic displacement. A mass of more than 440.000 tons of rock may have totally deformed the entire area where a wooden structure once existed (hypothetical dock or mooring).

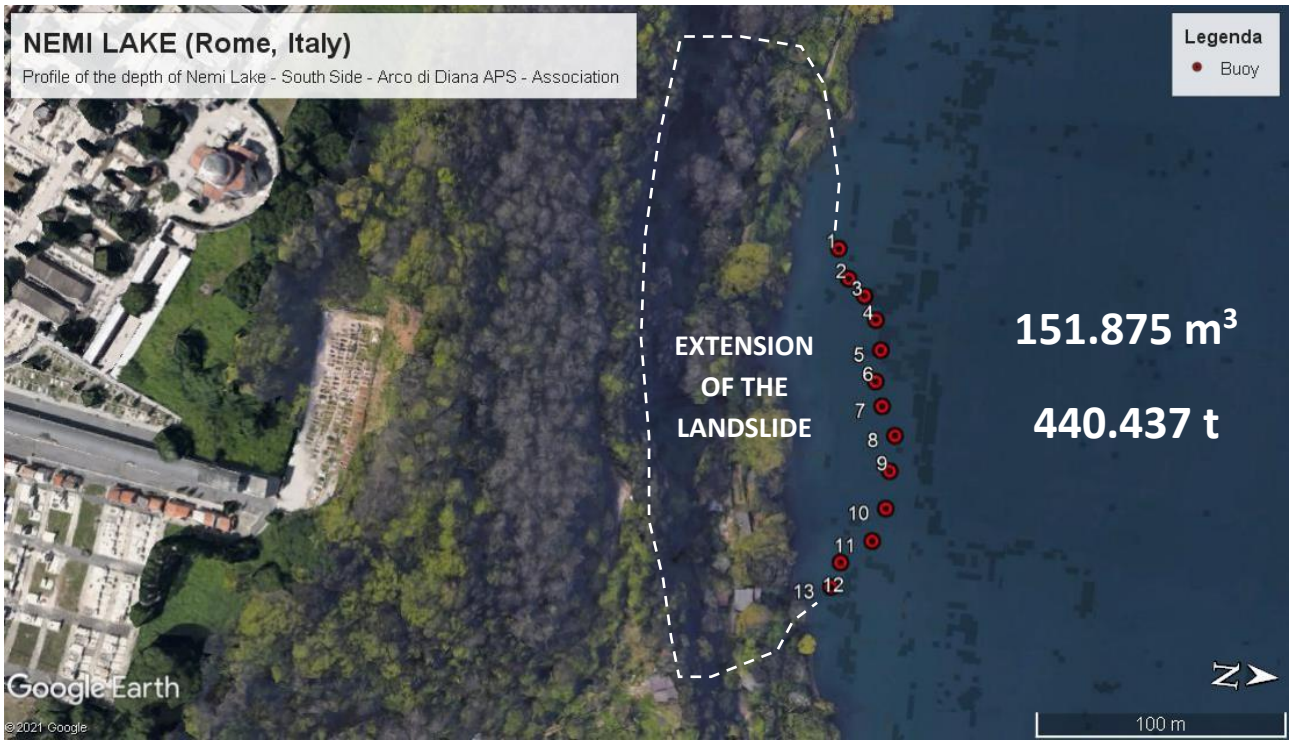


Fig. 10 - Extent of the landslide highlighted both in the water and on the shore. It measures 225 meters long and 100 meters wide (compared to the rock face). Credits: Arco di Diana APS - Google Earth Pro.

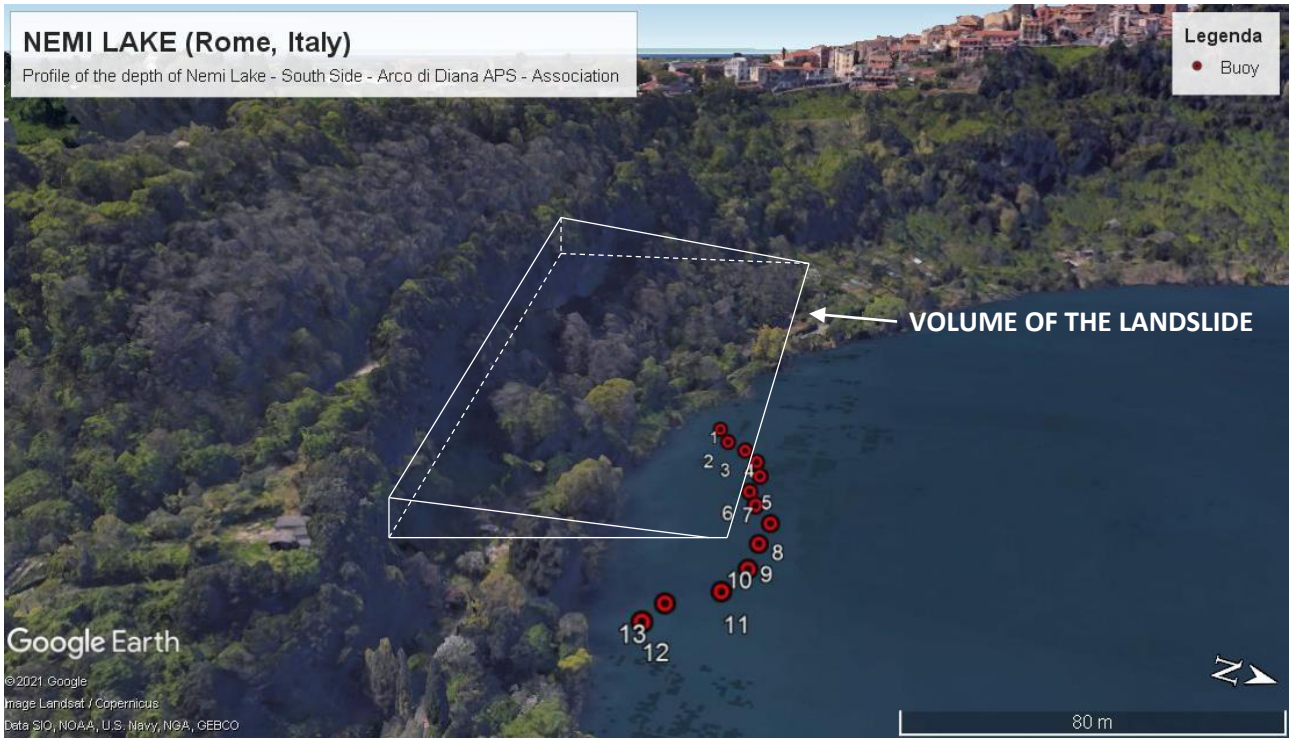


Fig. 11 - Triangular section volume of the landslide. Credits: Arco di Diana APS - Google Earth Pro.

The data confirmed by the research work of the researchers was able, for the first time ever, to document the existence of an extremely large rock mass, which fell from the wall of the volcanic crater, probably following a seismic event or due to the slow impoverishment of the lithic structures,

due to the infiltration of water. In fact, we are talking about a rock face that is sheer, and which is almost 90° inclined with respect to the ground below. As to the causes of the fall of this rock wall, to date it is only possible to put forward hypotheses, but the presence of the landslide can be documented.

Fig. 12 - Series of photos taken by the Arco di Diana Association, they highlight the presence of very ancient wooden structures, near the area where the measurements were made. The arrangement of these wooden structures follows the trend of the landslide, in the direction of the lake mirror. Credits: Arco di Diana APS.

3 - CONCLUSIONS

In conclusion of this research work, it can be confirmed that the south side of Lake Nemi has the remains of an ancient landslide, very extensive (22.500 m^2), and that this has moved and plastically shaped the underlying ground, moving and moving ancient archaeological elements, partly pouring them into the lake.

This denotes how this landslide has almost completely altered the morphism of the place, a morphism that must be taken into account in a subsequent archaeological investigation. These conclusions were reached by calculating the extent of the landslide itself and its extension with respect to everything that is today above it:

- Trees, plantations.
- Homes, estates, buildings.
- Streets, man-made environment.
- Natural areas.

What was once is no longer so today, as the environment has undergone a plastic modification of the pedosphere. The hypothesis that the landslide has buried part of the anthropic ecosystem is certainly not to be excluded, also given the proximity of the anthropized elements of ancient origin still visible today in the immediate vicinity.

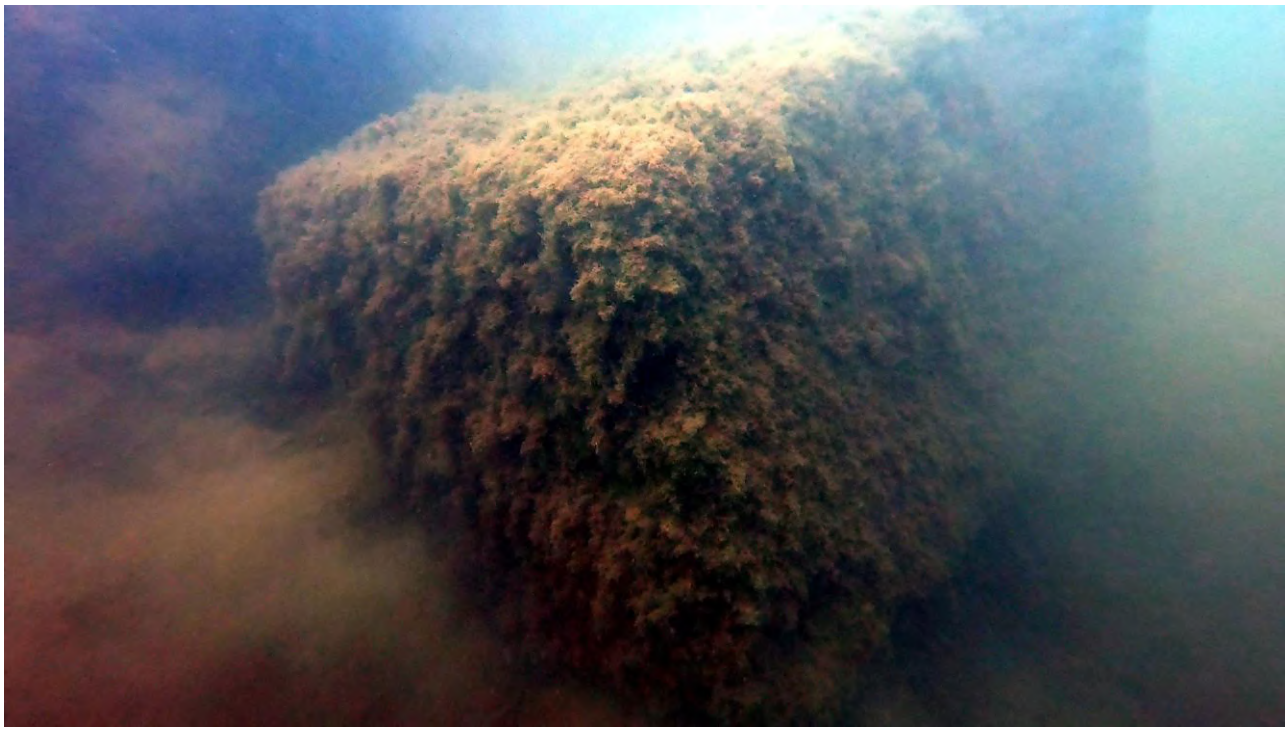


Fig. 13 – Square stone block, taken from below the waters of Nemi Lake a short distance from buoy no. 11 and 12. Credits: Davide Carbone, by kind concession.

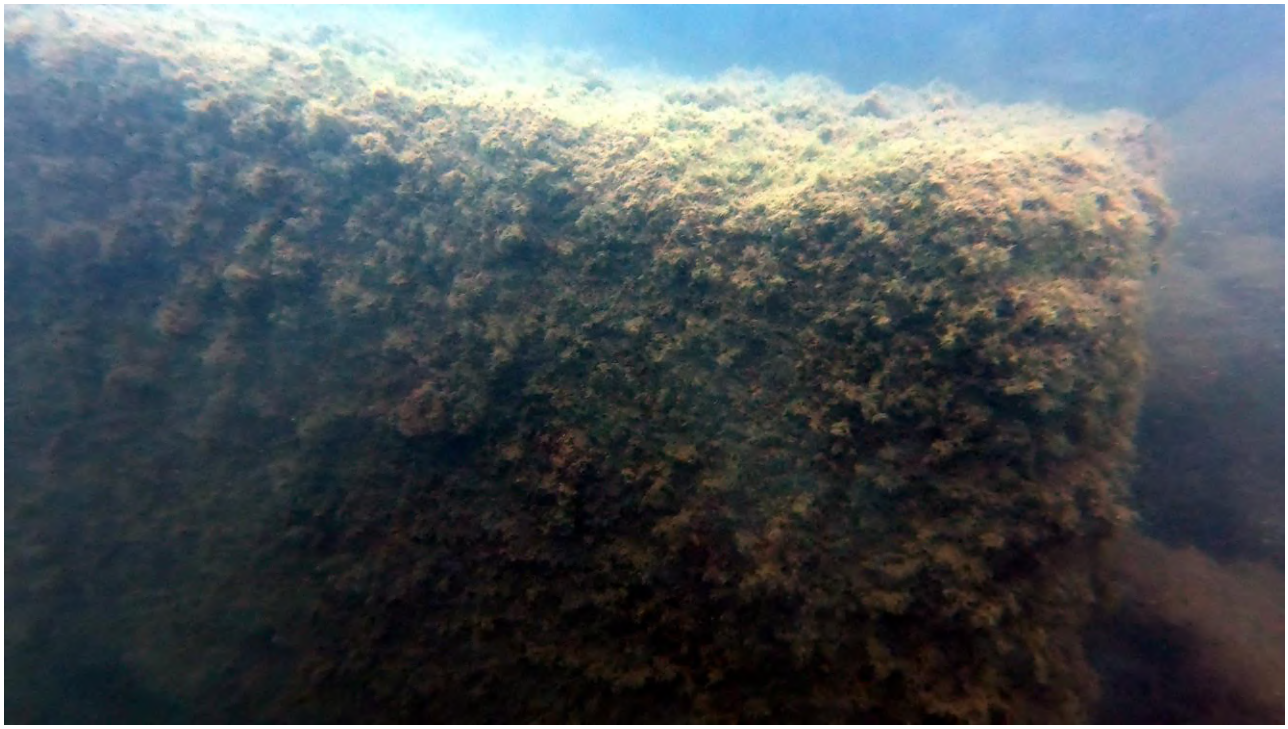


Fig. 14 - Square stone block, taken from below the waters of Nemi Lake a short distance from buoy no. 11 and 12. Credits: Davide Carbone, by kind concession.

Near buoy no. 11 and buoy no. 12, it was possible to identify, as already mentioned, a squared block (**Fig. 13** and **Fig. 14**), whose position suggests that it must have been part of a wall structure located near the lake mirror and probably similar to others structures of this kind, made up of stone blocks, always found on the shore of Nemi Lake. This block indicates that the landslide has displaced all

the anthropogenic elements, making them then roll to the bottom of the lake, where they then moved. The research was then able to document a second smaller block positioned between buoys **10** and **11**, but not documented with photos or videos.

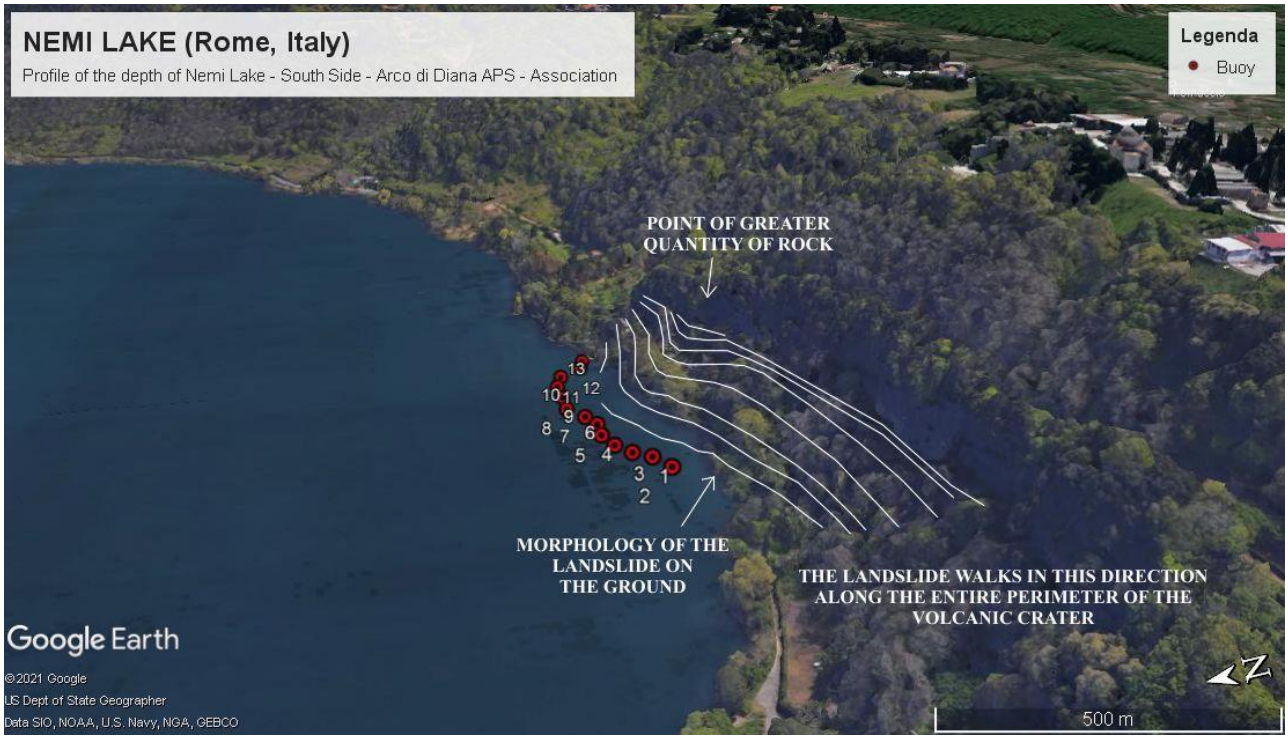


Fig. 15 - Satellite and three-dimensional map of the landslide area (volcanic crater of Nemi Lake). We observe the trend of the rocks present on the ground, located outside the lake mirror. It is evident that in this point there was a greater amount of rock then collapsed towards the ground, such as to move the entire surface of the soil and with it also what had once been built by man. Credits: Arco di Diana APS - Google Earth Pro.

In the **Fig. 15**, the trend of the ground surface is observed, in the area subject to the study by the researchers of the Arco di Diana APS Association, it is clear that most of the quantity of boulders and rocks is present in the facing area. at the buoys (**Fig. 16**, **17**, **18**, **19** and **20**). This shows us unequivocally how the fall of the rock has completely changed the surface of the soil by moving and burying what was once built by man.

In this case, the photographic documentation was created between 2018 and 2021 (**Fig. 16-20**) by the Arco di Diana APS Association, during countless excursions and explorations aimed at documenting the state of the territory, and more precisely the area where the rock face collapsed. There is no doubt on this point, given that the area is characterized by a high amount of stone material, characterized by very large blocks, some of which are more than 1.5 meters in diameter.

In some places, trees have sprung up under these boulders (**Fig. 20**), which today cover the entire area, demonstrating that it is an ancient and therefore not recent collapse. The area is obviously of a volcanic type, being a lake formed in a mouth of the ancient volcanic building (Vulcano Laziale), and which is subject to earthquakes, even of a certain intensity, as the Vulcano Laziale is a quiescent and not extinct volcano. The hypothesis is that the collapse, as has already been said, may have occurred either following a telluric event or due to the constant depletion of the wall structure due to infiltration of water and vegetation

(obviously we are talking about a determined effect in the course of tens of years, if not centuries).

Fig. 16 - Boulders present below the rock wall, adjacent to the research area. At this point we are +4 meters above the water level of Nemi Lake. The large amount of large rocks testifies to the presence of an ancient landslide. Credits: Daniele Cataldi – Arco di Diana APS.

Fig. 17 - Boulders present below the rock wall, adjacent to the research area. At this point we are +4 meters above the water level of Nemi Lake. The large amount of large rocks testifies to the presence of an ancient landslide. Credits: Daniele Cataldi – Arco di Diana APS.

Fig. 18 - Boulders present below the rock wall, adjacent to the research area. At this point we are +4 meters above the water level of Nemi Lake. The large amount of large rocks testifies to the presence of an ancient landslide. Credits: Daniele Cataldi – Arco di Diana APS.

Fig. 19 - Boulders present below the rock wall, adjacent to the research area. At this point we are +4 meters above the water level of Nemi Lake. The large amount of large rocks testifies to the presence of an ancient landslide. Credits: Daniele Cataldi – Arco di Diana APS.

Fig. 20 - Boulders present below the rock wall, adjacent to the research area. At this point we are +4 meters above the water level of Nemi Lake. The large amount of large rocks testifies to the presence of an ancient landslide. Credits: Daniele Cataldi – Arco di Diana APS.

All this is a further confirmation of the hypothesis that the rocky landslide has almost totally changed the conformation of the soil and of the anthropized habitat, collected thanks to the investigations and archaeological studies carried out by the Arco di Diana APS Association, which operates mainly in the territory of Alban Hills.

Statement: Part of this study was delivered to the Archaeological Superintendence of Rome on August 6, 2021, and accepted.

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