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Preventive conservation and museological study of the monument of early Christian Catacombs in Melos Island - Greece.

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Περίληψη.

Το υπό μελέτη μνημείο είναι ένα κοινοτικό κοιμητήριο πρωτοχριστιανικής περιόδου, το οποίο είναι λαξευμένο στο φυσικό βράχο της περιοχής Τρυπητής στο νησί της Μήλου. Πρόκειται για ένα υπόγειο σύμπλεγμα τριών κύριων στοών, με τάφους στα τοιχώματά τους που ονομάζονται «αρκοσόλια», καθώς κι επιδαπέδιους τάφους.

Ο κύριος στόχος αυτής της εργασίας είναι η διαμόρφωση του χώρου του μνημείου των Κατακομβών της Μήλου, με σκοπό την ανάδειξη του εκπαιδευτικού, ψυχαγωγικού και θρησκευτικού χαρακτήρα του μνημειακού συνόλου μέσω της μουσειολογικής μελέτης.

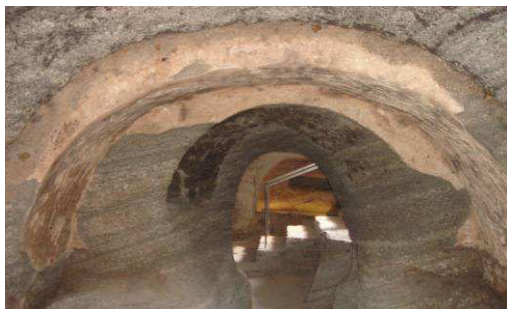
Κύριο μέλημα για την εφαρμογή της μελέτης είναι η εξασφάλιση της καλής κατάστασης διατήρησης του μνημείου στο βάθος του χρόνου, καθώς και η εξασφάλιση ασφαλούς περιβάλλοντος για τους επισκέπτες. Για το λόγο αυτό, είναι απαραίτητη η προσαρμογή και εφαρμογή των κανόνων της προληπτικής συντήρησης στα ιδιαίτερα περιβαλλοντικά δεδομένα του μνημείου.

Η μουσειολογική μελέτη αφορά στη διαμόρφωση και λειτουργία των χώρων του μνημείου σύμφωνα με τις αρχές της νέας μουσειολογίας.

Abstract.

The present study concerns the preventive conservation and museological study of the monument of early Christian Catacombs in Melos Island.

The monument of early Christian Catacombs is a community cemetery, located in the region of Trypiti in Melos Island. It is an underground complex carved into the natural rock, consisting of three main galleries. The galleries include carved graves in the ground and also carved graves in their walls which are called "arcosoliums" because of their arced shape.



View of the main entrance from Gallery A in its present form.



Gallery B in its present form arcosoliums are distinguished on the walls of the gallery.

The main objective of this work is the configuration of the space of the monument, in order to enhance the educational, recreational and religious character of the monumental ensemble through the museological study.

The main concern for the implementation of the study is to ensure the good preservation status of the monument in the depth of time, and also to ensure a secure environment for the visitors. For this reason, it is necessary to adapt and apply the rules of preventive conservation on the specific environmental data of the monument.

The museological study concerns the shaping and operation of the premises of the monument in accordance with the principles of new museology.

Key words.

Environmental parameters, carbon dioxide limitation, functionality, accessibility, disabled people, education, entertainment, new technologies.



Typical arcosolium form.

Introduction.

In order to enforce the rules of preventive conservation at the monument, a study of environmental parameters took place. Through the study of environmental factors in the closed visiting area, the most important factor that places preventive conservation and museological study in a common denominator comes out.

This factor is to limit the production of carbon dioxide (CO₂) and to control the change of atmospheric environment and temperature in the closed visiting area of the monument during summer months where massive visit is observed.

By solving this problem of great importance, through recommendations arising from the science of preventive conservation, it is formulating the operating modes and visiting times of the monument. There also follows the layout of space by applying the principles of functionality based on the accessibility for persons with disabilities and finally the formulation of proposals for education and entertainment for every kind of visitor.

Materials and methods.

For the realization of the environmental parameters in the monument there were used digital moisture, temperature meters (tiny tags) and a portable digital device measuring the levels of carbon dioxide in the atmosphere. Furthermore, there were used results from previous studies¹ which were performed by specialized scientists at the monument of Early

¹ Christofiou, A., 2001, "The hitherto surveys on Catacombs of Melos Island by the Ministry of Culture and the National Technical University of Athens ", Greek Ministry of Culture, Athens.

Christian Catacombs of Melos Island in order to compare old and new results, and also to conduct conclusions about the conservation status of the monument over time.

The preventive conservation recommendations are based on the results of the environmental parameters study.

The museological study, as far as it concerns the functionality of the visiting area, is based on disabled accessibility standards as defined by international regulations. The proposals for education and entertainment are based on recognized theories of learning and in the implementation of new technologies.

Results and discussion.

The results of the environmental parameters study are:

TEMPERATURE: During the year, the temperature inside the galleries varies from 20 °C to 23 °C. It is evidenced that the temperature remains constant during the year².

MOISTURE: From instrumental monitoring of the relative humidity it comes that it is between 86% and 100%. The consistency of the rock and its good preservation over time is attributed in the presence of moisture. At the same time, the way of water circulation is a key factor in the erosion of rock and mortar by water³.

CARBON DIOXIDE:

Why do we care? Because it affects the monument and human.

The atmospheric CO₂ solubilizes the calcite slowly, generating calcium bicarbonate, which is a factor of deterioration for the rock and the wall paintings (mortar and coloring) of the monument⁴.

Exposure limits for human.

The limits of human exposure to CO₂ according to the Environmental Protection Agency (EPA) of the USA is the concentration of carbon dioxide not to be exceeding 1000 ppm (0,1%).

Furthermore, in accordance with ASHRAE 62-1989 standard the CO₂ level should be less than 1000 ppm⁵. -Furthermore, ASHRAE Standard 62-2001 recommends 700 ppm above

Minos N., 2009, "Measurements of carbon dioxide in the monument of Early Christian Catacombs in Melos Island", Ministry of Culture, Directorate of Conservation of Early and Ancient Monuments, p.p. 1-10

Rizopoulou, S., 2002, "Technical Report: Opening Gallery A entry and improving visitation at the monument of Catacombs in Melos Island, Phase II Environmental impact ", Greek Ministry of Culture, Athens.

Scoulikidis Th., Kritikou E., 1994, "Report on the mechanism of rock wear in the Catacombs of Melos Island and their protection", Department of Materials Science, Department of Chemical Engineering, National Technical University of Athens, Athens.

² Christofiou, A., 2001, "The hitherto surveys on Catacombs of Melos Island by the Ministry of Culture and the National Technical University of Athens ", Greek Ministry of Culture, Athens, p. 2.

³ Scoulikidis Th., Kritikou E., 1994, "Report on the mechanism of rock wear in the Catacombs of Melos Island and their protection", Department of Materials Science, Department of Chemical Engineering, National Technical University of Athens, Athens, p. 7

⁴ Lampropoulos, N., B., 2003, *Environment of museums, monuments and archaeological sites*, Athens, p. 321

⁵ ANSI/ASHRAE standard 62-1989, Ventilation for acceptable indoor air quality, April 26, 1998

the outdoor concentration as the upper limit for occupied classrooms (usually around 1,000 ppm)⁶.

Effect on the monument: The increased presence of CO₂ leads to temperature increase in the area and conducts to the confectioning of the limestone. In conjunction with the presence of increased moisture the substrate of wall paintings is influenced (there are formed cracks) and thus the statics of the monument⁷.

Effect on human: Health Effects. CO₂ is anasphyxiate. At concentrations above 1.5 percent, some loss of mental acuity has been noted. The recommended ASHRAE standard of 700 ppm above the outdoor concentration is to prevent body odor levels from being offensive⁸. Carbon dioxide in higher concentration than 1000 ppm can be toxic to human in prolonged exposure. It can cause elevated blood pressure, hallucinations, tremors and loss of consciousness after exposure to a high concentration for five to ten minutes.

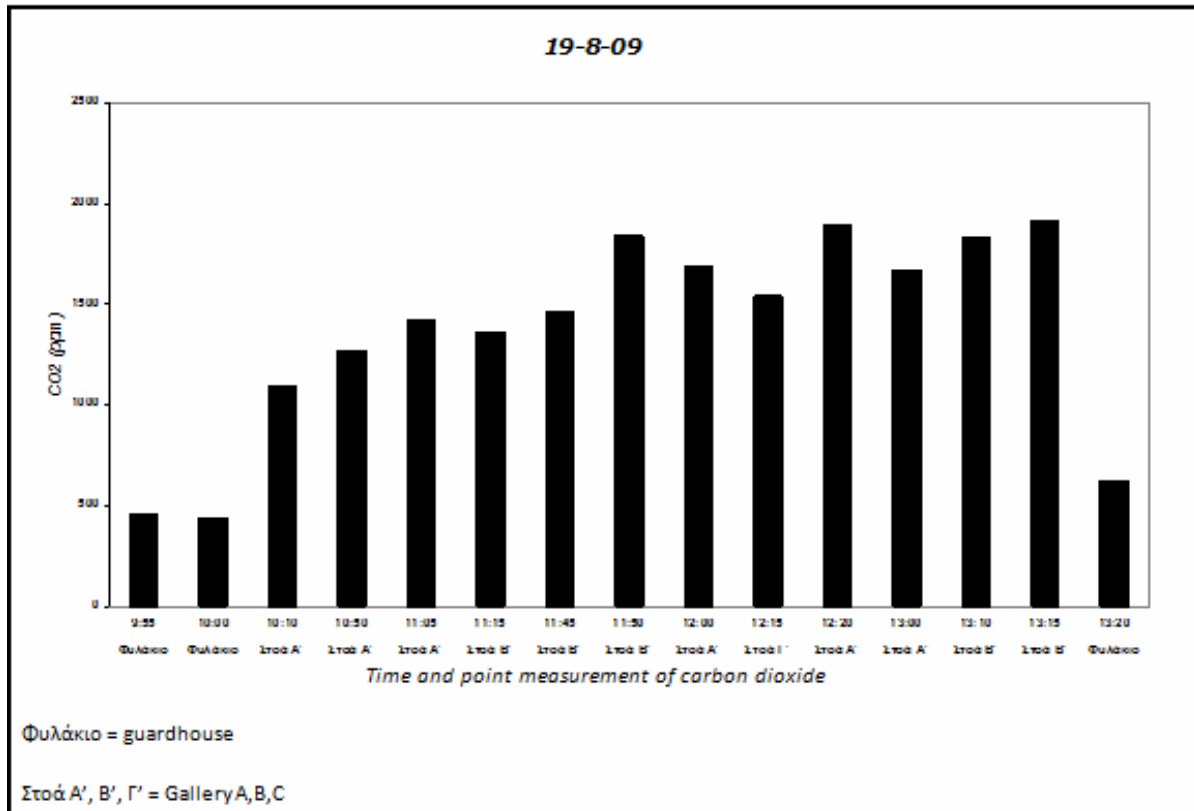
CO₂ measurements show that in massive visits the concentration of CO₂ exceeds the permissible limits. As we can see in the charts below, in massive visits concentrations touch and sometimes exceed the 2000 ppm. In general, CO₂ concentrations in massive visits range between 1400 and 1600 ppm, rate which is worrying.

It is also a fact that there is no natural ventilation, so the produced CO₂ does not find a way out and it is trapped in the closed visiting area. The typical concentration of CO₂ in the closed visiting area resets to 450 ppm in at least 10 hours, as observed from the measurements.

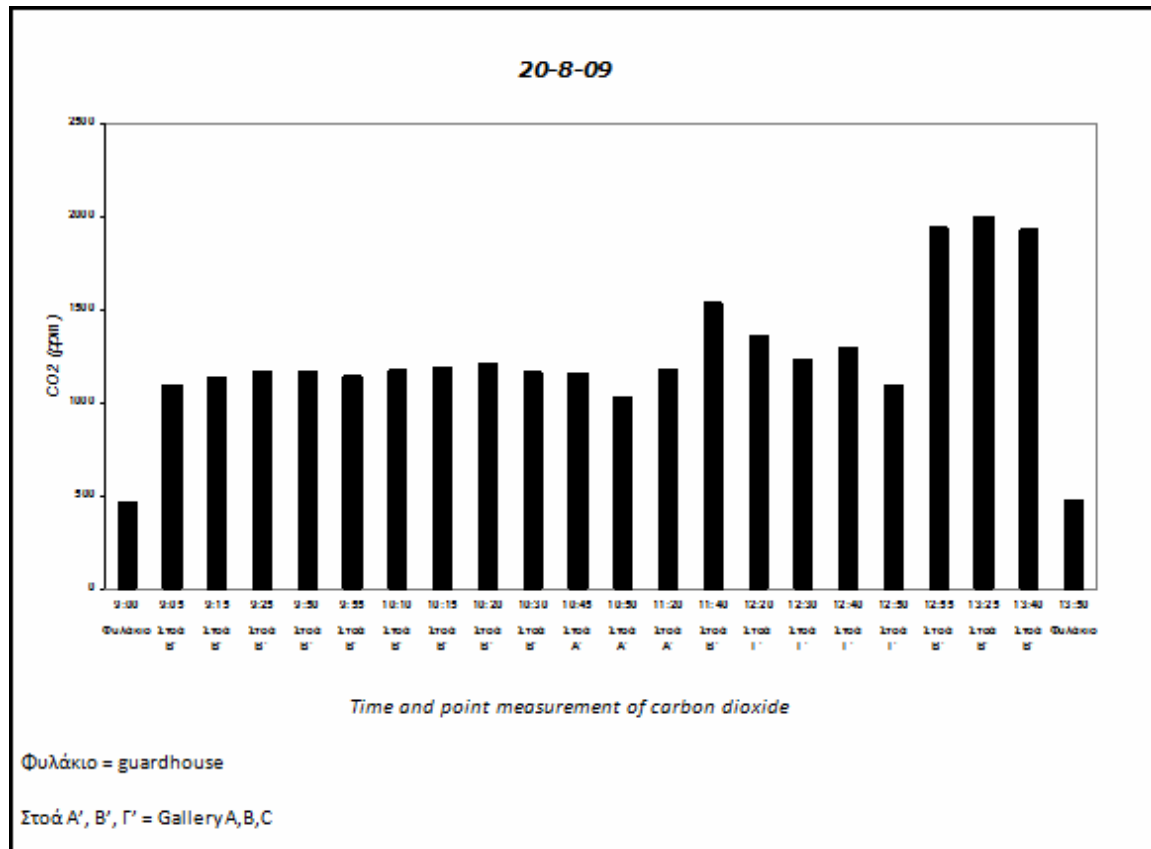
⁶ United States Environmental Protection Agency, IAQ Reference Guide, Appendix E - Typical Indoor Air Pollutants, Available at the website <http://www.epa.gov/iaq/schools/tfs/guidee.html>, last day of visit, 09/01/2013

⁷ Scoulikidis Th., Kritikou E., 1994, "Report on the mechanism of rock wear in the Catacombs of Melos Island and their protection", Department of Materials Science, Department of Chemical Engineering, National Technical University of Athens, Athens, p. 9

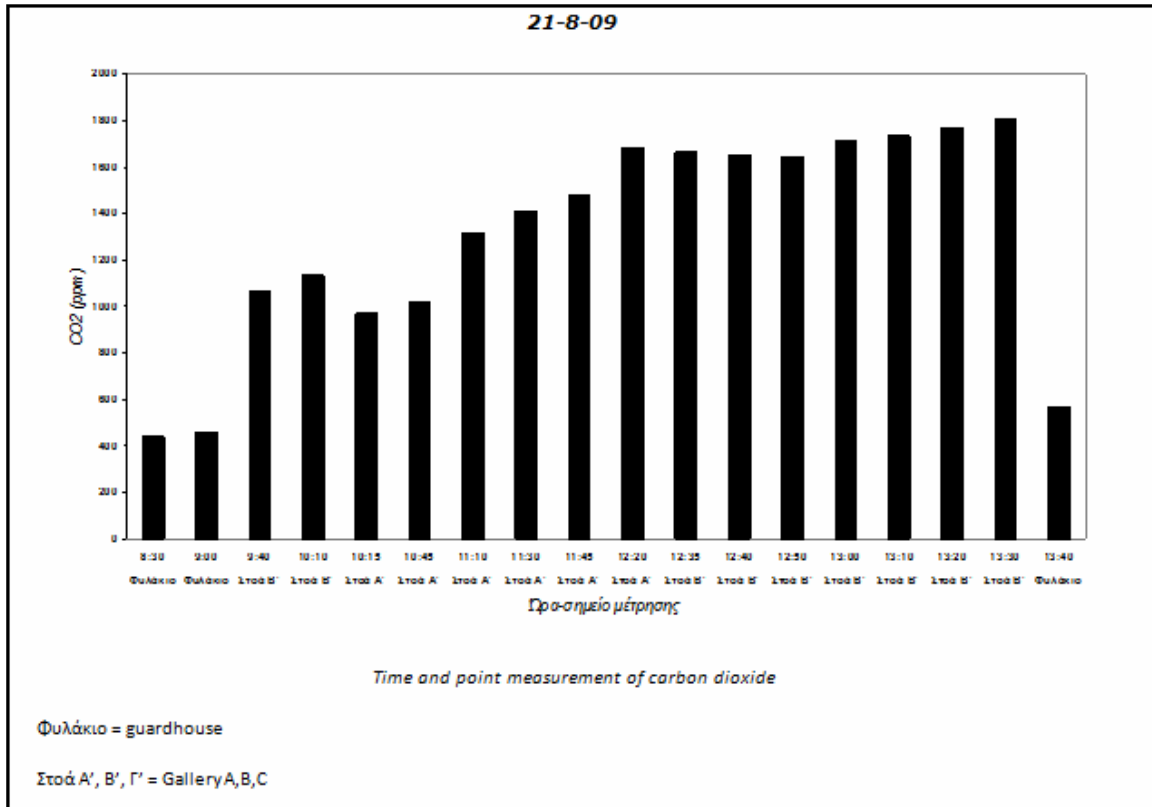
⁸ United States Environmental Protection Agency, IAQ Reference Guide, Appendix E - Typical Indoor Air Pollutants, Available at the website <http://www.epa.gov/iaq/schools/tfs/guidee.html>, last day of visit, 09/01/2013



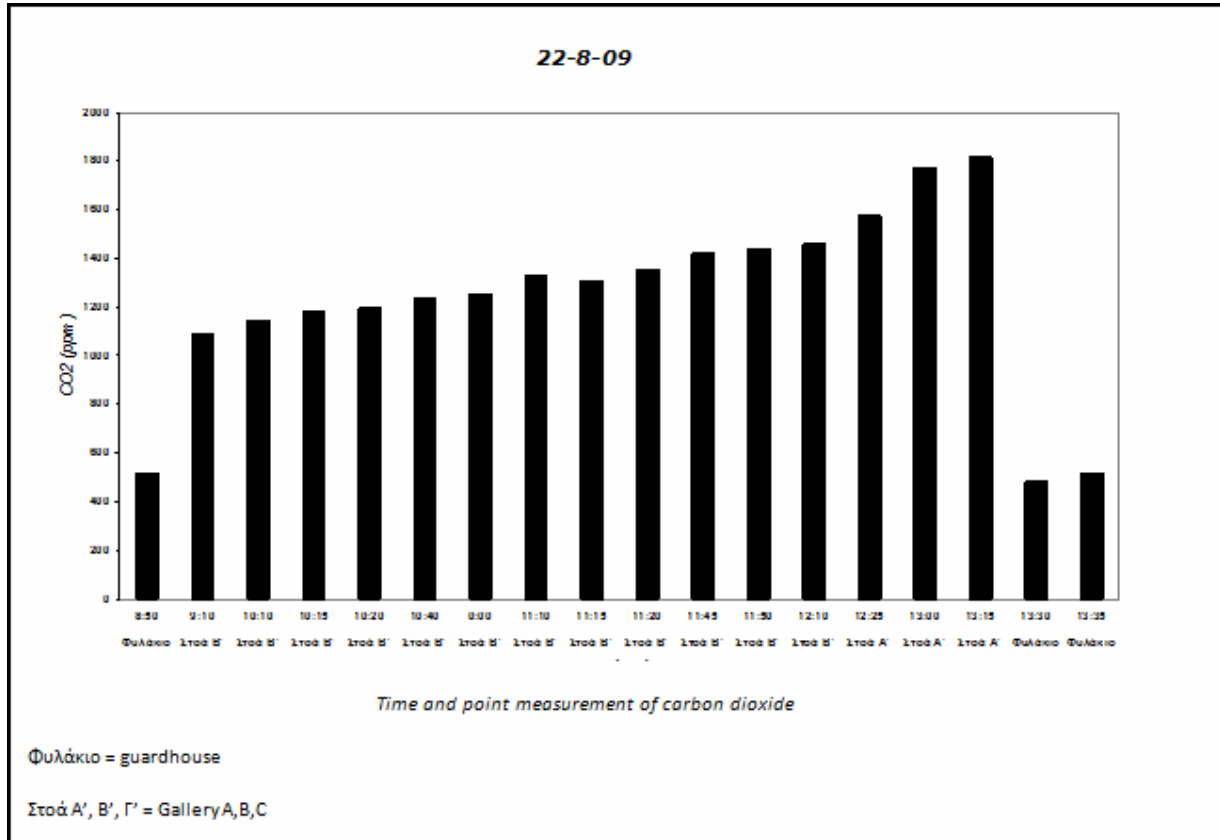
Number of visitors: 400, massive visit was observed at 10:50 a.m., 11:15 a.m., 12:15 p.m.



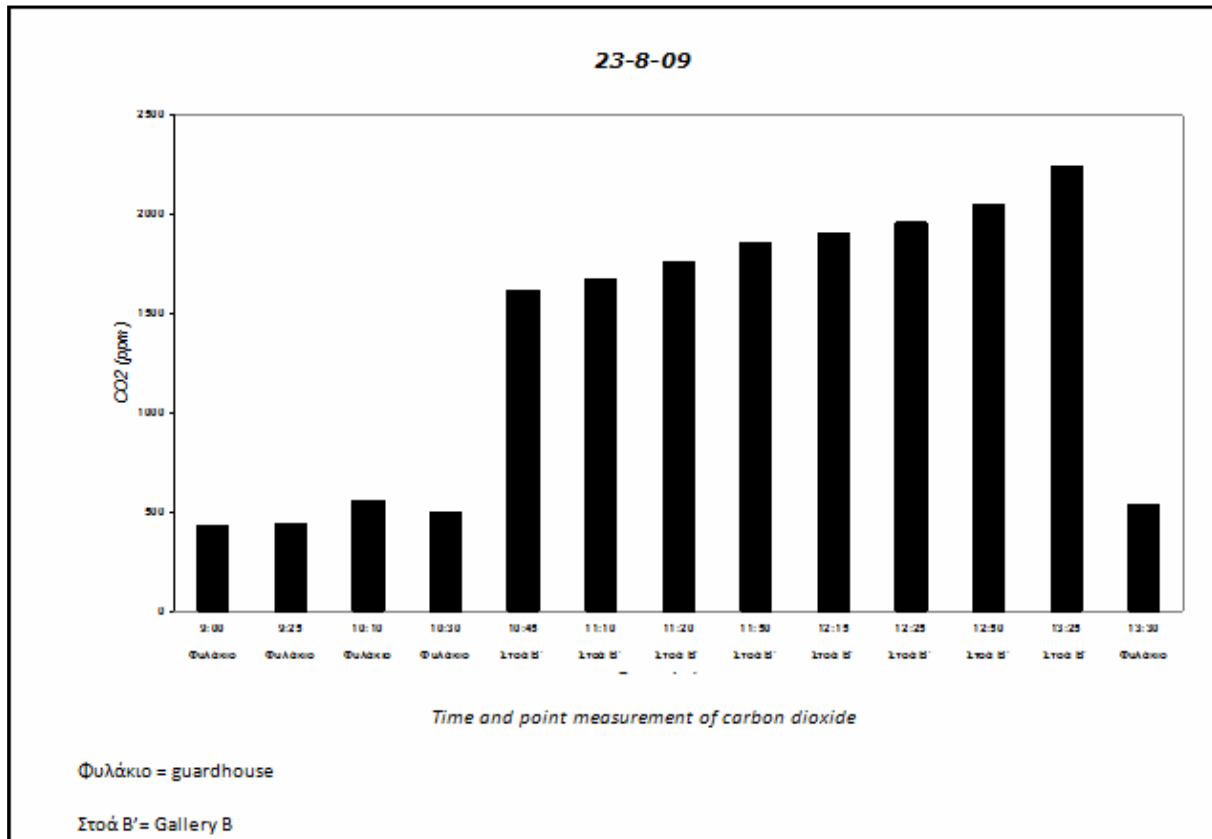
Number of visitors: 411, massive visit was observed at 11:20 a.m., 12:30 p.m., 12:55 p.m.



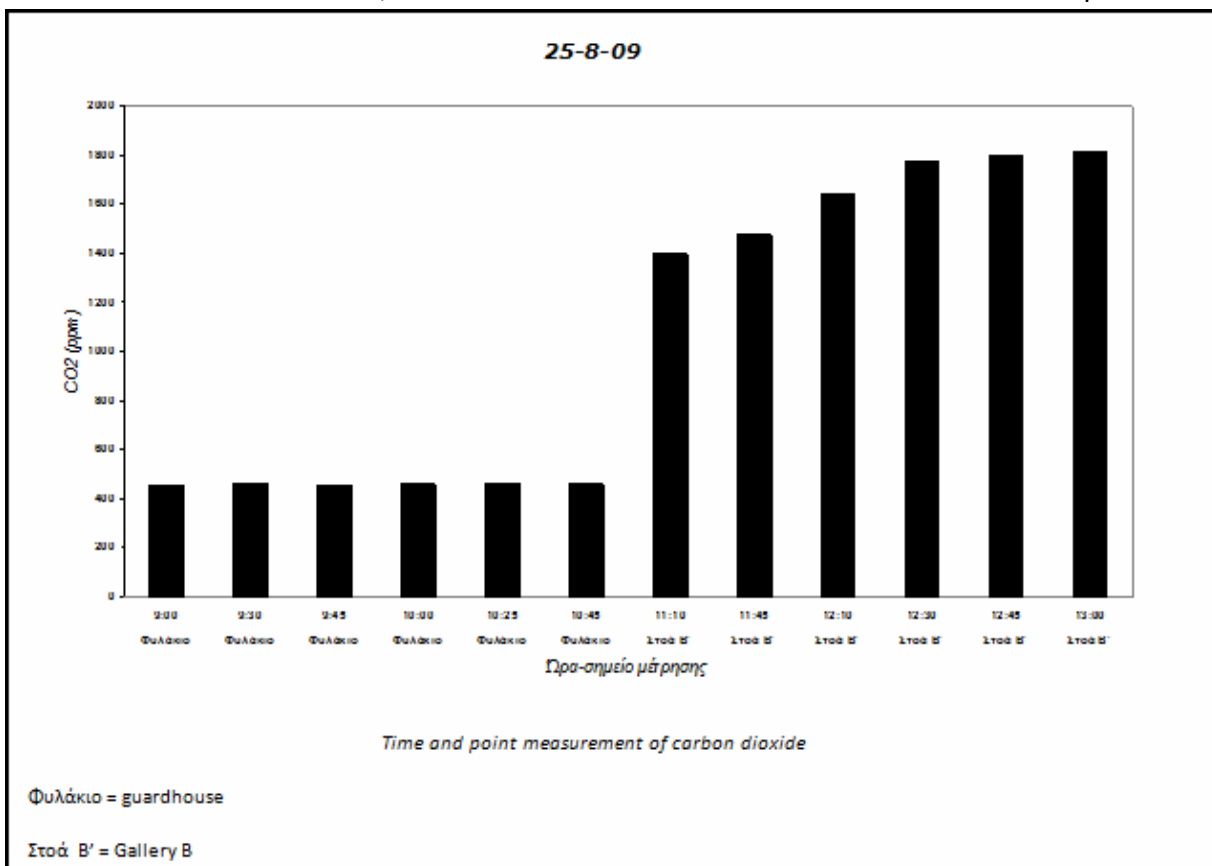
Number of visitors: 430, massive visit was observed at 10:45 a.m., 11:30 a.m., 11:45 p.m., 12:35 p.m., 12:50 p.m., 13:10 p.m..



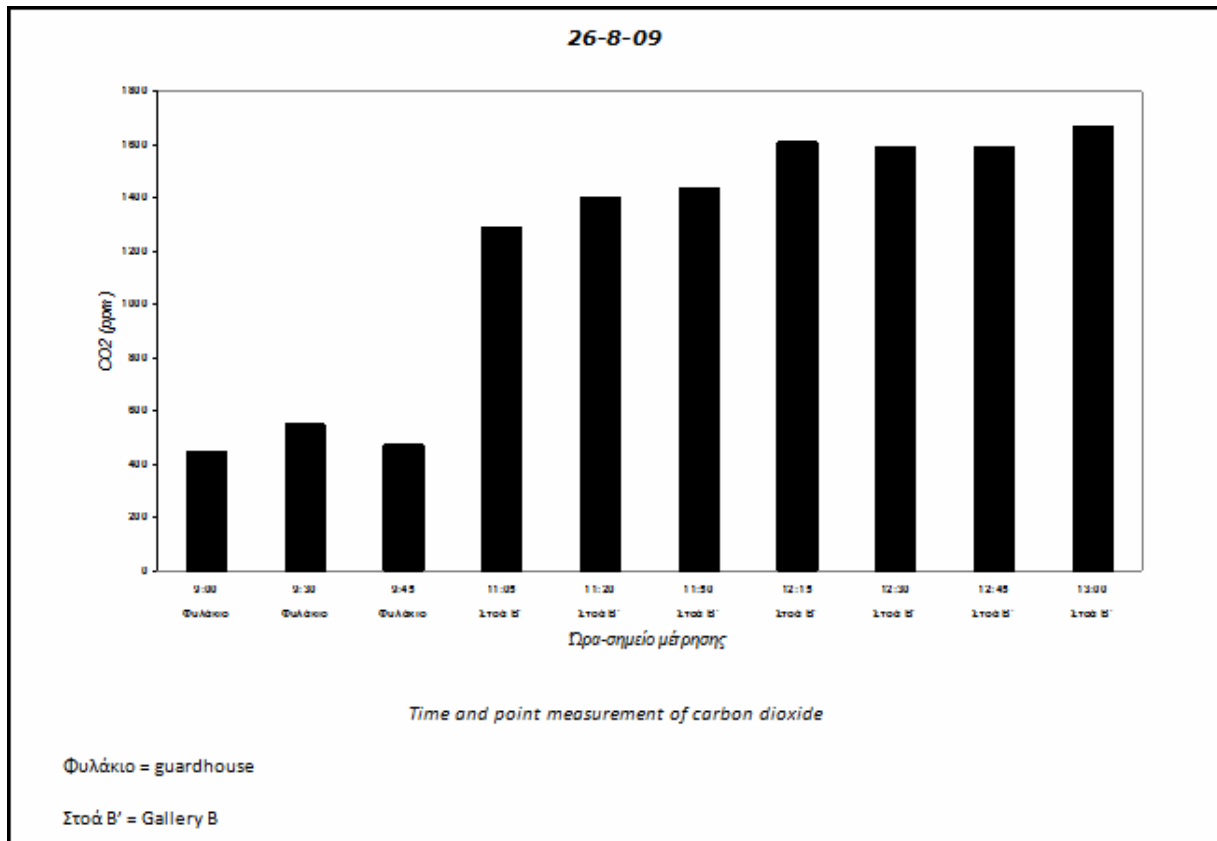
Number of visitors: 381, massive visits were observed from 9:10 a.m. to 13:00 p.m..



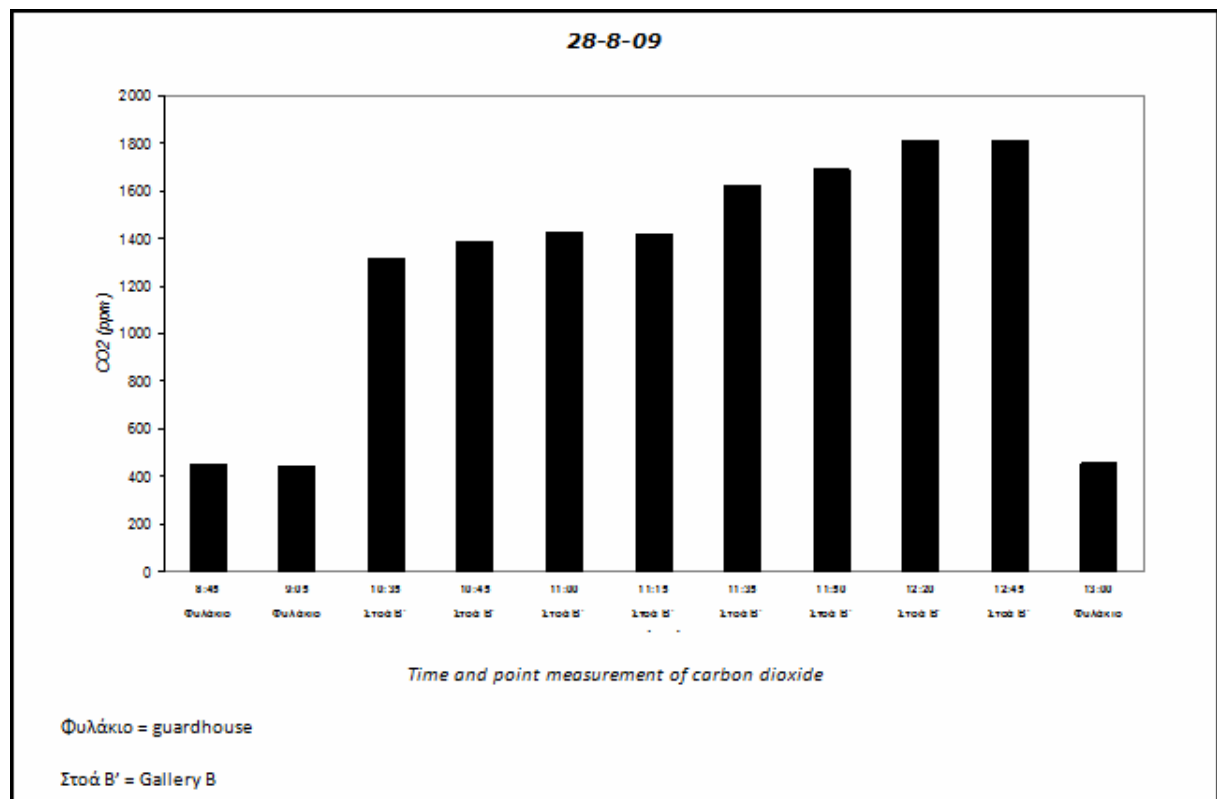
Number of visitors: 400, massive visit was observed from 10:30 a.m. to 12:50 p.m..



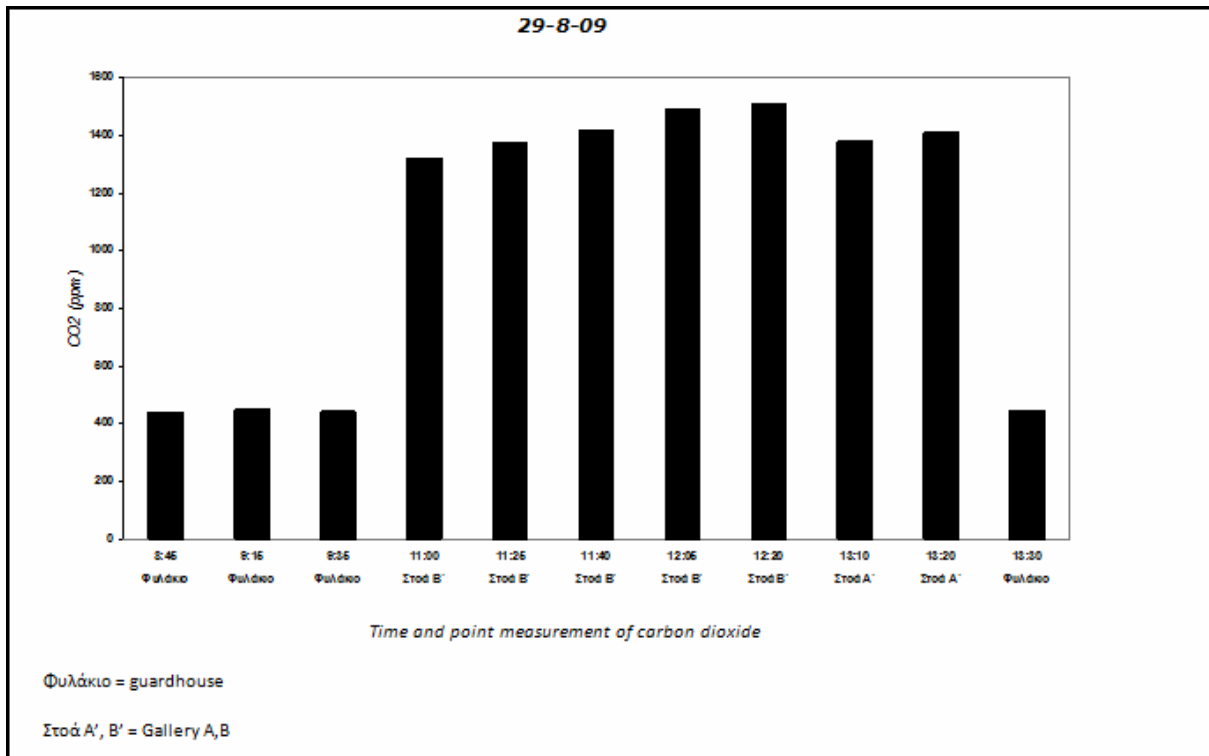
Number of visitors: 407, massive visit was observed at 10:45 a.m., 12:10 p.m., 12:45 p.m..



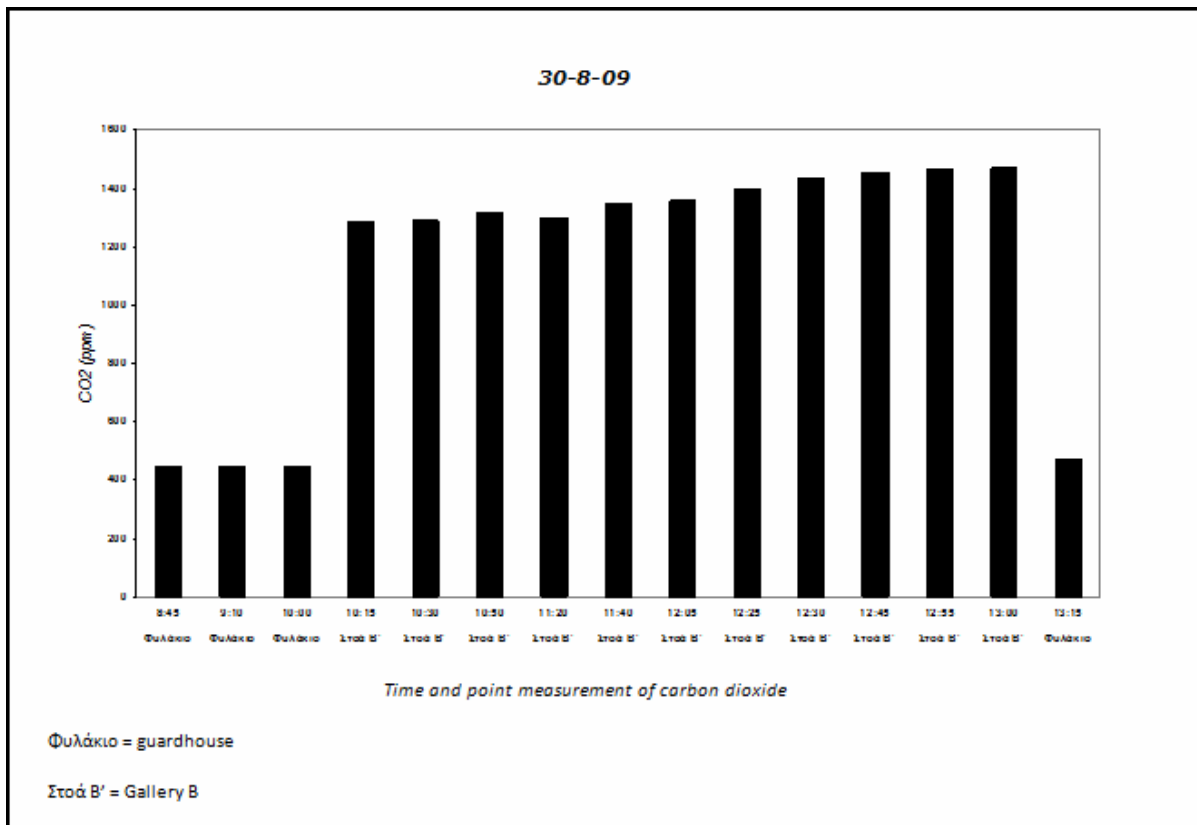
Number of visitors: 360, massive visit was observed from 11:05 a.m. to 12:45 p.m..



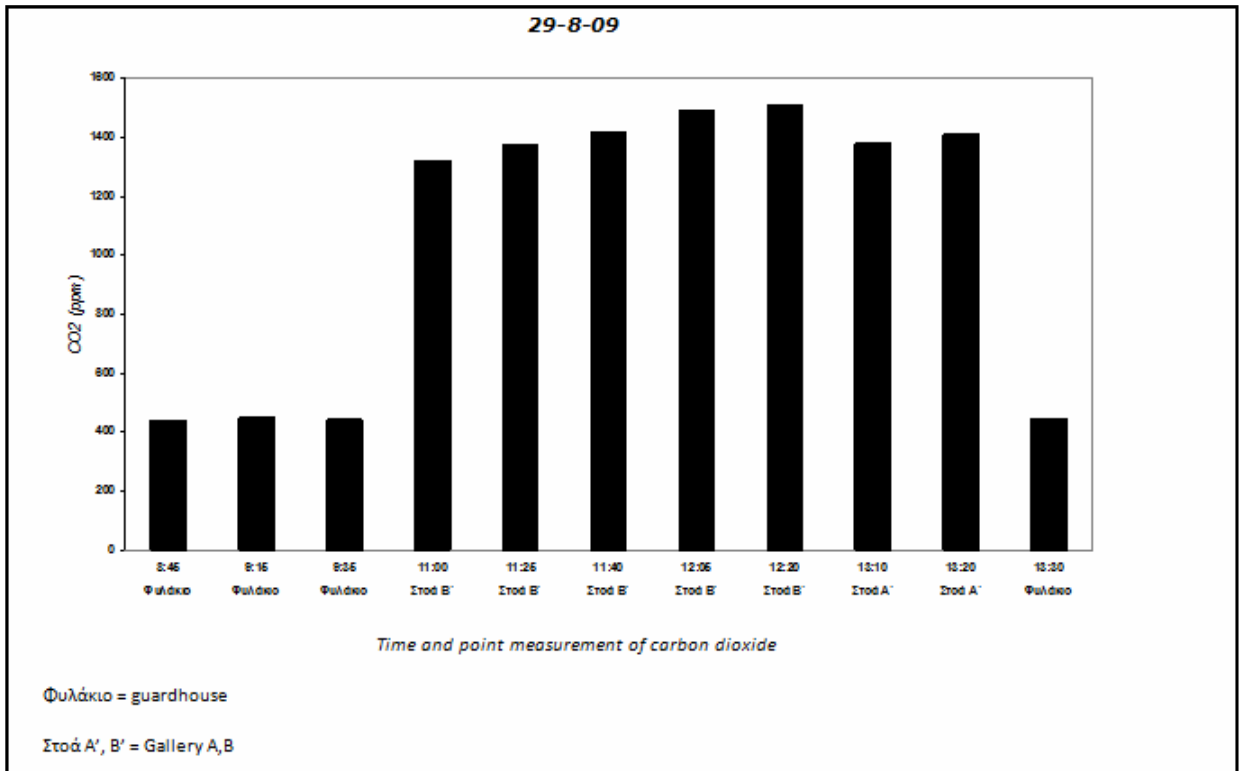
Number of visitors: 292, massive visit was observed from 10:35 a.m. to 12:20 p.m..



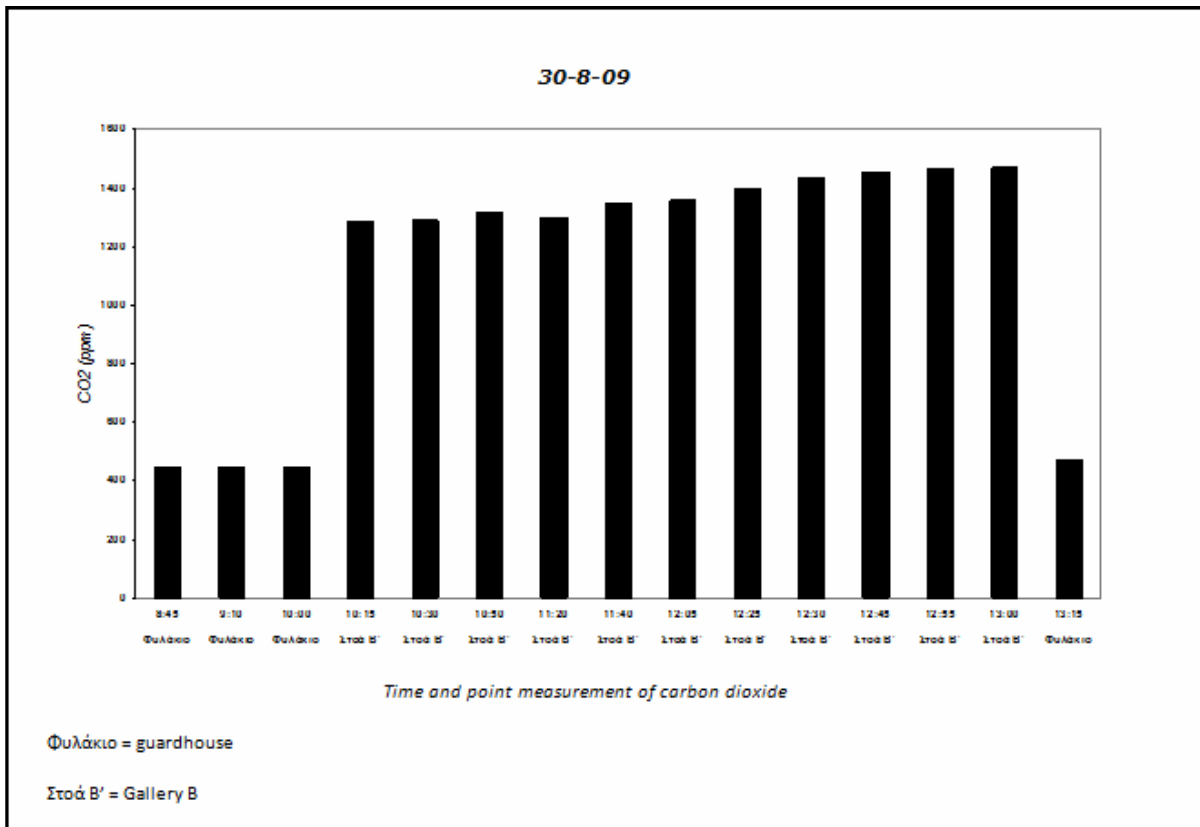
Number of visitors: 165, massive visit was observed from 11:00 a.m. to 13:10 p.m..



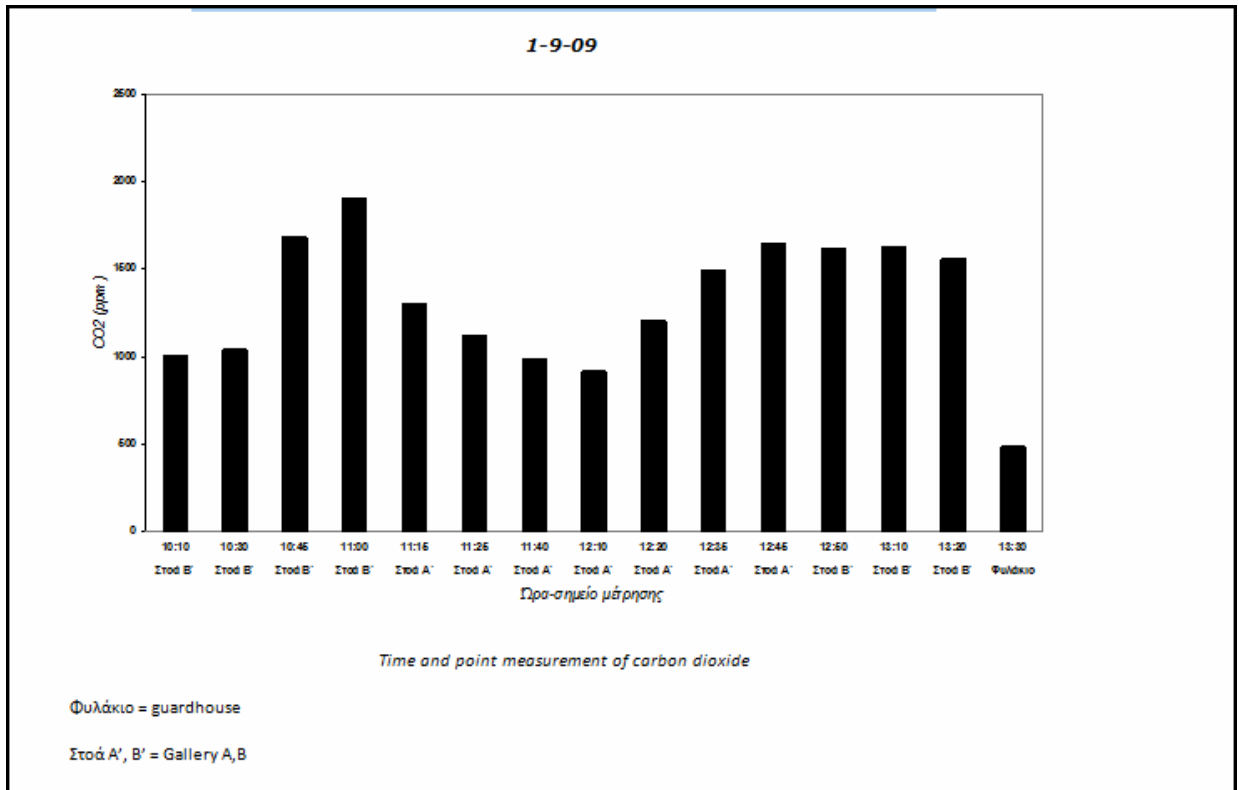
Number of visitors: 195, massive visit was observed from 10:15 a.m. to 13:00 p.m..



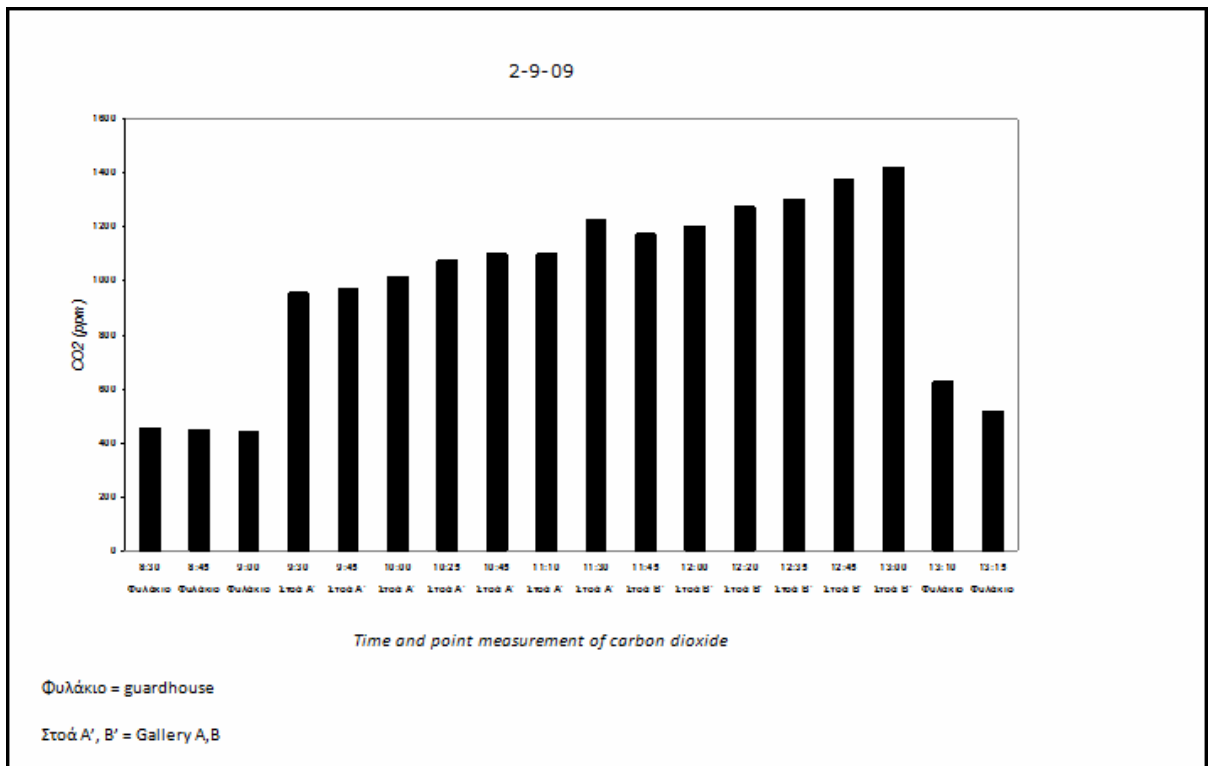
Number of visitors: 165, massive visit was observed from 11:00 a.m. to 13:10 p.m..



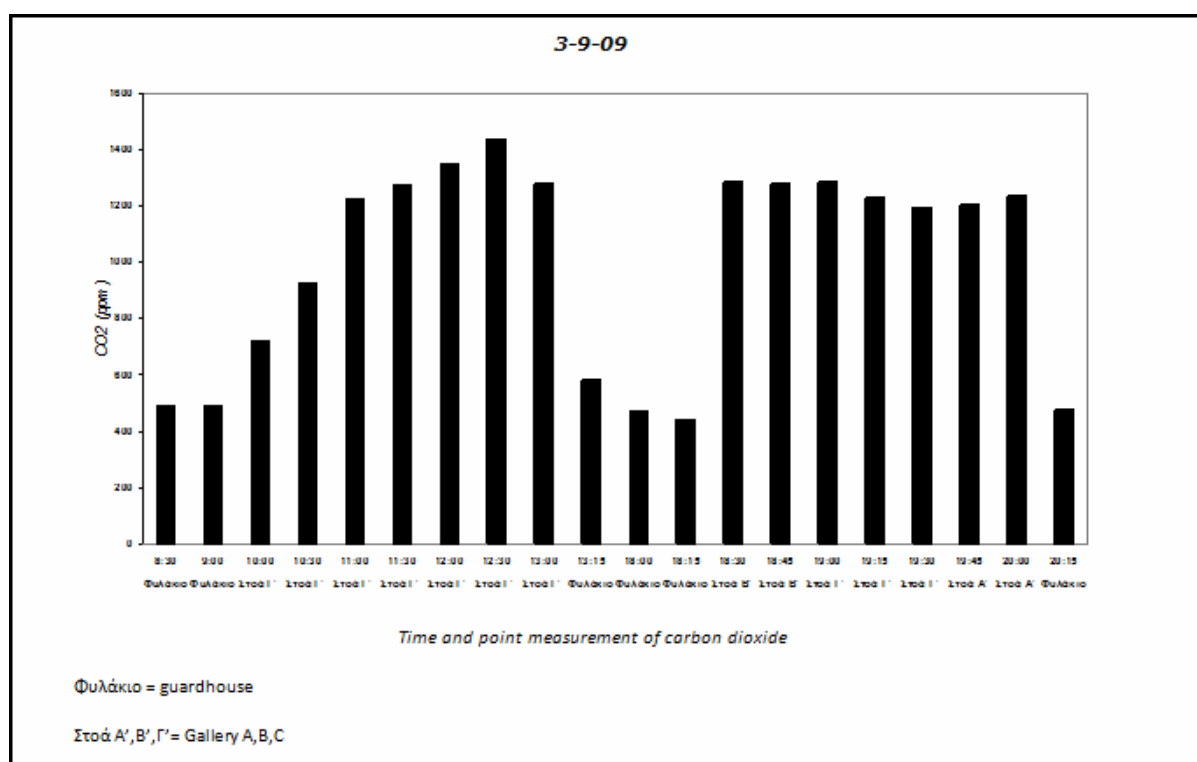
Number of visitors: 195, massive visit was observed from 10:15 a.m. to 13:00 p.m..



Number of visitors: 229, massive visit was observed at 10:30 a.m., 12:10 p.m., 12:45 p.m., 13:10 p.m..



Number of visitors: 154, massive visits were observed from 9:30 a.m. to 13:00 p.m..



Number of visitors: 152, massive visit was observed from 10:00 a.m. to 12:00 p.m..

LIGHT: The monument is illuminated artificially at certain times in the last thirty years.

The energy absorbed from infrared light raises temperature. This in turn increases the speed of damaging chemical reactions already occurring within the materials⁹. That also makes artificial lighting a factor in attracting biological formations.

BIOLOGICAL ATTACK: The materials used to the forming of the visiting area in combination with the artificial lighting installation to facilitate the visitation enables bacteria, roots and symbiotic microorganisms to recruit energy in order to develop¹⁰.

The combination of moisture and darkness prevails during the hours that the monument remains closed, and also the constant temperature favors the growth of fungi. For several years, the monument was a refuge for a swarm of bats and rodents, and rarely for reptiles.

⁹ Patkus Lindblom B., The environment: Protection from Light Damage, resources Preservation Leaflets, Walpole. Available at the website http://www.nedcc.org/resources/leaflets/2The_Environment/04ProtectionFromLight.php (Last day of visit: 09-01-13).

¹⁰ Rizopoulou, S., 2002, "Technical Report: Opening Gallery A entry and improving visitation at the monument of Catacombs in Melos Island, Phase II Environmental impact ", Greek Ministry of Culture, Athens, p. 5

NOISE: Within the galleries there is audibility, which comes from the open area of the monument. Noise which is caused by visitors is within the permissible limits of noise level for the monument.

The monument remained through the centuries because, until its discovery in 1844, the entrances of the galleries had been embanked and there was created a stable microclimate in the enclosed space. As noted in the results of the studies, the monument still keeps steady in its internal space when closed.

So, in order to keep the monument open to visitors, a solution should be found there should be find a solution to maintain stable environmental conditions throughout the year and to reduce the concentration of CO₂ in the area during massive visiting periods (summer months).

Suggestions for Preventive Conservation.

A. Control of the climatic conditions during periods of high traffic.

To reduce CO₂ production and control of temperature change during the summer months where there is high visitation, it is proposed:

Carry out visits by groups from 10 to 15 people.

The eve of the group in the room should not exceed the 15 minutes time.

The circulation of the group during their stay should be in a designed museological route from its entrance to its exit in the closed visiting area of the monument.

B. Opening Hours

It is necessary to extend the opening hours during the evening with a half hour break at noon. During the break the monument will be closed without lighting and with the entrance's door window left opened, for natural renewal and balancing the atmospheric environment.

The schedule could be as follows: 9.00 a.m.-2.00 p.m. and 5.30 p.m.-8.00 p.m..



Drum of an arcosolium which bears religious inscription.

C. Actions to preserve the monument in depth of time

During winter months where is little or no traffic, the monument should be kept closed and opened only for a brief review of the conservation status by a group of scientists.

Monitoring is recommended to be done once every two months. Before the visit to the monument for the control, there should be preceded by preparation, by opening the window of the door without activating the lighting.

Furthermore, it can be opened for limited times during this period for schoolchildren visiting.

MUSEOLOGICAL STUDY

The first thought on designing the study is the access of people with disabilities because access to culture is a universal right and every public place must be open and accessible to all.

Today, the difficulties in the design and manufacture for hindered people have to be overcome. Changing an unwelcoming space, does not require a huge financial effort and it is a matter of conscience and democratic functioning of the state.

Let us not forget that a friendly built environment for Persons with Disabilities makes also a friendlier environment for the entire population of the society.

Configuration.

A. Parking area.

B.



Parking area as it is today.

Provided:

1. The configuration of parking spaces for disabled vehicles, tourist buses, cars and motorcycles.

2. The configuration of visitors stopping area in the shade.

3. The placement a. of an information stand and b. of an interactive information table.

It is also recommended to create a space for a specific application program of entertainment and education for people who are unable to move down to the closed visiting area, despite the appropriate configuration of spaces for access of disabled people to the monument.

4. The placement of a refreshment stand and

5. The placement of chemical toilets for each group of visitors.

C. Gradient scale.



Gradient scale as it is today.

In the study there has been made provision for

1. Access for disabled people.
2. Stops at the stair landings and installation of seats where feasible.
3. Installing awnings for sun protection (with releasable construction in order to be stored during the winter months)
4. Stand with information on the stair landings, where feasible.

C. Opened visiting area.



Opened visiting area as it is today.

1. The guardhouse. It is planned for cutting tickets, sharing cards with priority numbers for grouping 10 to 15 people. It is recommended that the group meets in the area outside of the guardhouse in order to enter the closed visiting area of the monument.

2. Waiting area: it is provided the installation of awnings for sun protection, the development of an appropriate waiting area for people with disabilities, the placement of fixed seats for the elderly and vulnerable people and the placement of a stand with information about the monument. Finally, it is provided the fitting of audio and video instructions for each group of visitors.

D. Closed visiting area.



Closed visiting area as it is today.

The configuration of a museological route for a group of 10 to 15 people accompanying with a tour guide is planned. The visiting time should not be more than 15 minutes.

The visit to the site is proposed to be carried out by an official escort (in this case a guard) who will be responsible for keeping the time of the visit and the route, and the observance of safety rules.

Information and Education Suggestions for each group of visitors.

Under the multi-role which is required to develop the modern museum and the contemporary monumental space, education is undoubtedly its main orientation, placing it

among the key stakeholders of informal learning¹¹. And also, the aim of the museum and the archaeological site is the growth and development of knowledge, skills and the aesthetic criterion of the public¹².

For each group of visitor there could be available the following informational resources and means of education:

- a. Information in Greek and at least English installed on a stand in any area.
- b. Tour to be conducted by attendants group (existing employees of the Catacombs).

In particular, for the separate groups of visitors, there are recommended the following suggestions:

Foreign visitors

Installing audioguide system with language selection for foreign-language groups.

Students

For students, the creation of separate educational programs for groups of elementary, middle school and high school students is recommended. Especially for elementary school students there can be created and become available a museum device, for the preparation of the class before the visit.

Adults.

For the adults it is proposed to design specific questions to be put to theme during the tour.

Elderly.

For older age groups the dialogue with the tour guide prior to the visit as well as a video projection in a specially designed space in the waiting area are proposed.

Families with children.

For families with children, it is proposed to have preparation materials which will be available before visiting the closed visiting area of the monument, according to which, the parent and child will enter into a process of "game". The acquaintance with the rules of the "game" can be done while waiting.

For disabled people.

For groups of people with disabilities, the configuration of a special kiosk in the parking area is proposed for the installation of projectors, interactive whiteboards and the placement of a scale model of the monument, where the members of the team will be able to touch.

In summary, the monument of early Christian Catacombs of Melos Island is a monument of immense value for our cultural heritage.

Through the museological study, it is given the ability to create even more factors to ensure good preservation of the monument and in parallel the advent of more visitors in the depth of time.

The site of the monument is fully exploited in accordance with the principles of new museology seeking both the educational as well as the recreational character of the monument to play a leading role.

¹¹ Hooper-Greenhill, E., 1992, *Museums and the Shaping of Knowledge*, Routledge, London and New York, p.2, and Hein, G., 2002, *Learning in the Museum*, Routledge, London, p.p. 6-7.

¹² Skramstad, H., 2004, "An agenda for museums in the twenty-first century", Anderson, G., *Reinventing the Museum, Historical and contemporary perspectives on the paradigm Shift*, Rowman & Little Publishers, Inc, Walnut Creek, p.p. 119-120.

Finally, the functionality and the ability to participate in the joy of communion in the experience of visiting from every visitor is the element that makes the monument of early Christian Catacombs of Melos Island, a cultural spot capable to mount on the cultural norms of the modern map.

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