Chapter four :

Includes the conclusions and results and recommendations of the study, a list of Arabic references , a list of foreign references and web sites that were used in the study.

3rd carried out an experimental study using some cleaning materials, - Results have shown the effectiveness of methyl cellulose poultics + 30 grams of Ammonium carbonate in removing concretions of gypsum and cement, - Sodium bicarbonate + water by the ratio 1:10 gave a very good result in dissolving the concretions of gypsum and cement, -Toluene was effective in removing beewax by dissolving, as well as turpentine added to ethyl alcohol by the ratio 1:1, - Ethyl alcohol with distilled water by the ratio 3% and 5% gave good results for nail polish and inks, - using actone with distilled water by the ratio 3% and 5% gave good results in the removing of paintings.

Topic three :

deals with the applied study, on three relics of granite:

1 – the gate tower **S3**.

2 –the Sphinx **S5**.

3 - right jumb the entrance of the Lighthouse of Alexandria **S1**.

The researcher recorded the following forms of deterioration on the gate tower **S3**, the Sphinx **S5**, and the right jumb **S1** as follows: Exfoliation – scaling – contour scaling - colouration - Roughness – insects – deposits.

In addition Sphinx **S5**, and the right jumb **S1** both suffering from cracks – salts – missing parts and granular desintigration.

Also ,Sphinx **S5** and gate tower **S3** both suffering from the presence of brown spots tend to red as a result of the presence of berries which fall from the trees surrounding the artefacts at roman theatre.

Simple cleaning process was carried out, inwhich tests and analyzes were applied , then the researcher propose a plan for treatment and maintenance of the three pieces.

Finally , the researcher put a proposed plan for museum displaying of the three relics of granite **S3** , **S5**& **S1** , taking advantage from the techniques of display presented in the third topic from the second chapter.

Chapter three :

Topic one :

It deals with the investigations and analysis of the components of the granite samples S1 a & S1 b (under study) , samples under microscope (different enlargments 200X), belongs to the Granitoids group in which crystals of basic minerals can be distinguished by the naked eye which are quartz – plagioclase feldspar – orthoclase feldspar – biotite, two samples S4 a & S4 b are calcic small shells ,calcareous limestone concretions and fouling, Samples S2, S3, S1 a & S1 b have been studied by the scanning electron microscope (SEM), Which confirmed that the sample S2 also is in more and more severe damage than the sample S3 and the samples S1 a & S1b of the lighthouse,then studing the chemical composition of samples of granite S1a and S1 b .

Studies and analysis were carried out by X-ray diffraction (XRD) inorder to determine the components and clay minerals of the mortar sample S5 consists of sand, Calcite as main components in addition to clay (Albite) , S4 of marine concretions from calcite and sample S1 of granite quartz followed by microcline feldspar.

After that the microbiological studies which showed the presence of the fungus baking mold Rhizopus, and the fungus Aspergillus Candidus the most common and widespread .

Topic two :

1st deals with an experimental laboratoral study of the effect of salts on the granite stones the aging process by sodium chloride , sodium sulfate and ammonium bicarbonate, using scanning electron microscope (sem) to the samples before and after weathering tests, physical properties, which showed that sodium chloride and sodium sulfate showed severe damage to the pink granite cubes specially after exposure to high temperature above 450 degrees.

Temperature above 750 to 900 degrees showed the most severe damage to the pink granite cubes that became highly fragmented and dominated by a reddish-orange colour as a result of alteration of mica minerals, appearing of small golden crystals in a great number, 2nd undertaken a study on the effect of some consoldation materials on granite, proving that the samples consolidated with Wacker-OH 100 dissolved in ethyl alcohol 10% gave good penetration without blocking the pores and gave granite highest resistance to pressure.

Topic two :

Introducing the environmental factors of the new displaying of the granite monuments which are completely different from those of marine environment and leads to the appearance of new forms of damage that can be observed on granite monuments in different sites of the study.

Deterioration factors are mechanical, physiochemical and biological factors indoor and outside door, new forms of damage that can be observed on granite monuments at different Alexandrian museums of the study which deal with sunken cultural heritage as following: cracks - exfoliation - scaling — granular disintegration - rounding - Roughness - missing parts - Perforation – biological decay and reddish brown stains.

Ending with the cleaning process shown the possibility of using lasers both types of Nd: YAG and Excimer Laser in treatment, then introducing three methods of cleaning using water, misting , washing(using the spraying and compression) and steam methods.

Topic three :

Deals with the preparation of granite monuments for display, several objectives to be achieved to get a good display of the artifacts and their protection as there are used many techniques that make the display interesting and useful, such as animated films -holograms - clear Pamphlets - the use of voice guidance and computer games and simple science experiments - diorams - Using Theatrical Guidance and virtual reality experiences.

several types of museums, including the indoor museums , open-air museums and in situ museums, types of museum displaying: the 1st type direct display (permanent) and the second type indirect display (temporary), Introducing a number of exhibitions of the submerged treasures of alexandria, which have been loaned to varies countries.

After that discussing the museum display, preventive maintenance , conservation and restoration of the artifacts, Also identify the successful development of showcases and its role in providing an appropriate environment for the artifacts, use of Central adaptive devices - partial control devices or local organizations or the use of silica gel for protecting the granite monuments from the damage of photochemical factors, and devices to protect the exhibits from air pollution.

summary

Chapter one :

Topic one :

Beginning with an introduction, then research problem, Altsaullac, the importance , limits, postulates hypotheses and Methodology of the study, and ends with the previous studies.

Topic two :

Deals with the topography of the ancient city built by Alexander the great , its eastern harbour its Facilities and royal palaces during the Ptolemaic and Roman era, mentioning the early beginnings of the studies of underwater archeology in Alexandria to identify those establishments that became submerged under the sea level. mentioning the devices used in the process of maritime survey, e-measurement (EDM) - triangulation method - Satellites (GPS - side- scan sonar - (DGPS) - remote vehicles and deep (Rov), and ends with the surveys of the archaeological missions F.Goddio, J-Y Empereur and Tzalas.

Topic three :

Deals with plastic arts and the uses of granite in Alexandrian sculpture and architecture in the Hellenistic and Roman period, and the most important Alexandrian characteristics and features of this period, the most significant was the Alexandrian Corinthian capitals which came as a result of the development of classical styles and its integration with the Egyptian style to produce a kind of mixed style shown in Alexandrian sculpture and architecture, through the Facilities of the Royal quarter , the eastern harbour and Pharos (qaitbay).

Chapter two:

Topic one :

Introducing granite as an element, its natural , mechanical and thermal properties, and the weathering mechanism of granite , its formation, physical & mechanical weathering in warm & cold deserts, Then addressing factors that lead to damage of granite monuments found in the marine environment, which are divided into physiochemical factors (fouling- sedimentation- water- temperature – oxygen – salts), biological factors (micro-organisms - algae - bacteria - fungi - lichens) , mechanical and natural factors, then introducing the methods of treatment and restoration of granite monuments excavated from the marine environment, beginning with the 1st step of first aid to the last step of assembling ,dowelling and Completion.

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Faculty of Fine Arts
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(Applied Study on Selected Monuments)

Thesis
Submitted for Master degree
in fine arts- Restoration Department
Major Specialization / Sculpture Restoration

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