Faculty Of Archaeology

Cairo University

PROCEEDINGS OF THE FIRST INTERNATIONAL CONFERENCE

Egypt And Mediterranean Countries Through Ages

15-18 October 2014

Faculty Of Archaeology - Cairo University

volume 3

Chairman of the Conference
Prof. Dr. Mohamed Hamza Ismail Al-Haddad
Dean of the Faculty

Conference Coordinator
Prof. Dr. Gomaa Abdel-Maksoud
Vice Dean for Graduate Studies and Research

Academy Of Scientific Research And Technology

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Preface

During the last triennium (2011-2014) the Faculty of Archaeology – Cairo University, aimed to develop the abilities and improve the skills of its entire staff in the field of scientific research. The Faculty of Archaeology obtained the first position within the Humanities Faculties at Cairo University in the field of international publications. The faculty also held two international conferences: the first one entitled "Prehistoric Ages", the second one entitled "Islamic Archaeology in the East". Now we are proud to hold the third international conference of the Faculty entitled "Egypt and Mediterranean through Ages".

The Mediterranean Sea has always been a major joint factor and canal of cultural communication among different civilizations which had an important role in the progress of human culture and the development of human race since prehistoric ages up till now.

The number of accepted papers submitted to this conference reached ninety three. The papers submitted in Arabic are distributed as follows: thirty one in the field of prehistoric ages and historic ages, twenty five in the field of medieval and Islamic ages and eight in the field of conservation. Twenty nine papers were submitted in English language.

I pray to Allah that the conference proceeds successfully, and that the participants are able to contribute with their scientific additions and new theories in the field of archaeology.

Before I put my pen down I would like to thank Prof. Dr. Gomaa Abdel Maksoud - Vice Dean of the Faculty for Post-graduate Studies and Research and Co-coordinator of the conference, for his great effort with his team, who worked hard in the preparation of the conference.

Special thanks go to Prof. Dr. Gaber Gad Nassar - President of Cairo University for providing support to the Faculty of Archaeology on all levels, especially in the field of scientific research. I would also like to thank Prof. Dr. Gamal Esmat - Vice President of the University for Post-graduate Studies and Cultural Relations and Mr. Yousri Ibrahim – general secretary of the University who solved all administrative and financial difficulties which we faced prior to this conference.

Many thanks to them all

Chairman of the Conference

Prof. Dr. Mohamed Hamza Ismail Al-Haddad

Dean of the Faculty

Introduction

Monuments and artifacts in Egypt and Mediterranean countries have faced a lot of threats and similar problems throughout the ages. Archaeologists and researchers in Mediterranean countries, who encountered these problems, have been therefore obliged to develop scientific methods in the fields of Archaeology and conservation. Their important role in solving these problems and threats, has led to revolutionary specialization in archaeological fields that changed concepts of specialists working in the field. Scientific developments have lead to change strategies for solving problems and threats on the long-term basis.

From here came the idea of this first international conference of "Egypt and Mediterranean countries through Ages" which will be held at the Faculty of Archaeology - Cairo University from 15th to 18th October 2014. The conference includes different scopes in the field of Archaeology with its branches and eras, in addition to the field of conservation and other topics that show the role of using modern technologies and basic sciences in the field of Archaeology.

I would personally like to thank Prof. Dr. Mohamed Hamza Ismail Al – Haddad – Dean of the Faculty and Chairman of conference who presented a lot of facilities and tackled many obstacles in order to organize this event, which the Faculty of Archaeology and Cairo University are honored to host. I would like also to thank Prof. Dr. Gaber Gad Nassar - President of Cairo University - for his unlimited support to the faculty and the conference. Many thanks go to Prof. Dr. Gamal Essmat - Vice president of the University for solving a lot of difficulties and continuous support.

Special thanks go the conference secretary and organizing committee as well as conference sponsors, who played a role in the success of this conference.

I am grateful to the participants, a unique specialized group of scientists and researchers working in the field of archaeology in Mediterranean countries, who have contributed with a large variety of papers, aiming to help solve problems related to monuments/ artifacts and their conservation in Mediterranean countries.

Wishing the participants a successful conference, which will hopefully enrich the field of archaeology with unique research, scientific discussions and recommendations which could be used in future decision making situations.

Conference Coordinator

Prof. Dr. Gomaa Abdel-Maksoud

Vice Dean for Graduate Studies and Research

First
Pre - history and Ancient periods

1st International Conference:Egypt and Mediterranean countries Through Ages

Burial Habits of Human Skeletal Remains in Jars from Archaeological Site of Sahab, Jordan: A Bioarchaeological and Conservation Study

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Abstract
This bioarchaeological and conservation study aimed to analyze and expand our understanding of the aspects of ancient people death practices, lived in Sahab, Jordan through conducting research on human skeletal remains found buried in Jars. After moving one of the big jars from the stores of Faculty of Archaeology and Anthropology – Yarmouk University of Jordan into the laboratory, the materials were separated and laid down in a scientific manner. Sex, age, and stature were estimated and pathologies were investigated. Samples were taken in order to monitor pH, and to condcut FTIR , XRD, and XRF. The materials were cleaned used different types of standardized methods. After that, the skeletons were consolidated, and some broken parts were brought together. In the last stage, the skeletons were coated as a preventive measure. Analysis conducted on these human skeletal remains showed that three human skeletons (one adult female, and a fetus (unknown sex), and an infant (unknown sex) were buried together in this jar. The preservation was very good as predicted by the monitored value of bone and soil samples pH with an average of 7.4. Different scenarios of their death and burial practices will be discussed.

Key words: Jordan, Sahab Burial Habits, Jars, Conservation, Bioarchaeology

Introduction

Archaeothanatology (Archaeology of death) is defined as the "the study of death and dying in antiquity and the circumstances surrounding them " (Al-Shroman, 2007) . This type of study is very important for bioarchaeologists and conservators to expand their understanding of the burial habits of past populations. One of the methods that enable them to do so is to study human skeletal remains unearthed from different archaeological sites of different archaeological periods.

Burial habits vary in space and time. Analyzing these habits enable researchers to draw clearer pictures on some of the aspects of ancient culture and civilizations (Brunson-Hadley and Mitchell, 2001). Fuethermore, Chesson and Schaub (2007) mentioned that many aspects of social complexity can be understood from bioarchaeological studies conducted on cemeteries.

Understanding burial customs of past populations in Jordan attracted a number of archaeologists, bioarchaeologists, and conservators who aimed to study those habits from different points of view. Al- Shroman and Khawileh (2011) published a thorough study in which they discussed burial practices through eras in Jordan from Natufians to Persians. In older study and mainly focus on burial habits in one single archaeological period, Ibrahim and Gordon (1986) published a book in which both analyzed in details burial habits in Roman Period by studying a cemetery at Queen Alia International Airport (QAIA).

In this study, a multidisciplinary approach was performed on three human skeletal remains found in a big jar from archaeological site of Sahab, Southern Jordan.

The Archaeological Site

Sahab is an important archaeological site located in the southern part of Jordan (For Location see Figure 1). The site was excavated for several seasons under the supervision of Professor Moawiyah Ibrahim. The most significant findings of these seasons of excavation was the findings of 1972 season.

During that season, the team unearthed eight burial jars in Tomb II Area C of Sahab Cave, which were dated back to Early Bronze Age (Ibrahim, Unpublished Report) (See Figure 2). Those jars were buried in a shape looked like “M”. These materials were found in a good preservation condition with a significant amount of dirt on them.

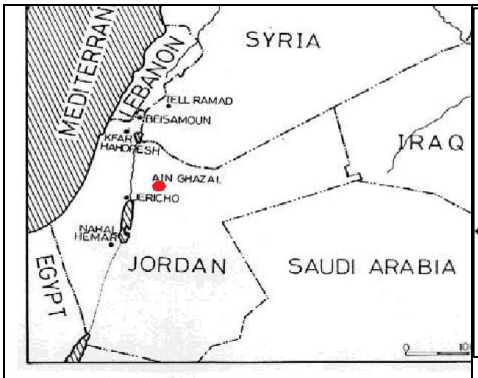

Fig. 1. Sahab archaeological site, Jordan.

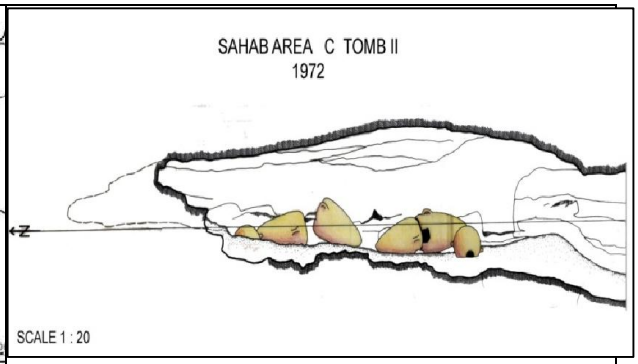

Fig.. 2. Sahab Area C Tomb II, 1972 (From Ibrahim, Unpublished Excavation Report).

Materials and Methods

Three human skeletons were found in a burial jar stored in Faculty of Archaeology and Anthropology Storage. The jar was among eight, which were unearthed in 1972 excavation season under Professor Mouawiah Ibrahim supervision. The jar was carefully transported from the store under the supervision of the two researchers to one of the laboratories in order to conduct this study.

Fig. 3. Jars in the Faculty of Archaeology and Anthropology-Yarmouk University Store.

Fig. 4. Safe transportation of one of the Jars to the laboratory.

Fig. 5. A Jar with skeletal remains.

Fig. 6. Three mandibles

Fig. 7. Adult female

Fig. 8. Skeletal remains of

of the three skeletons.	skeletal remains.	the fetus and infant.

Sexing the skeletons

The sex of the first skeleton was determined based on some of the morphological features of the hip bones. Both left and right hip bones were present. While the left one was broken into few fragments, the right into many fragments. The first sexual dimorphic feature to be examined was greater sciatic notch. Based on the rule of thumb, sex was determined as female, because greater sciatic notch was characterized as wide (Bass, 1995). Furthermore, preauricular sulcus was very developed, based on which was conclude that this skeleton was for female (Bass, 1995).

The subpubic angle was wide on both left and right hip bone, which also indicated that this skeleton is of female (Bass, 1995). Finally, the subpubic concavity was present on both hip bones (White, 2000), and this made us to reach the same determination. The sex of the two other skeletons was unknown, since the second one was fetus, and the third one was aged as (NB to 6 months old).

Ageing the Skeletons

To age the first skeleton, several age determination procedures were employed. The first skeleton was aged based on the following methods: fusion of medial clavicale and morphology of pubis symphysis (Suchy and Brooks in White 2000), and morphology of auricular surface (Lovejoy et al., 1985). The estimated age was 33 years.

The other two skeletons were aged using different methods. The second skeleton was aged based on the maximum length of right and left ulna (Johnston, 1962) . It was of fetus. The third skeleton was aged using the maximum length of left ulna (Johnston, 1962) (See Fig. 9). The age was (NB to 6 months).

Estimation of Stature of the Adult Female Skeleton

The stature was estimated only for adult female skeleton. It was determined based on the maximum length of right humerus (Trotter and Gleser, 1952). The estimated stature was 140.30 cm.

Pathology

The adult female skeleton was inspected visually for having any kind of disease. In spite of the development of a mild degree on the upper rim of one of the thoracic vertebra, and the presence of dental caries on the left lower second molar, it appeared that this skeleton is for individual who lived most of her life in a healthy manner. Osteophytes and dental caries will be discussed, in details, below.

Osteophytes

A mild degree of osteophytes was observed on the upper and lower rims of three of the thoracic vertebra (see Fig. 10). Osteophyte or lipping can be defined as extra bone formed on the rim(s) of the veretebrae or on the margins of the joints. Osteophytes may be as a result of early stage of diffuse idiopathic skeletal hyperostosis (DISH) (Forestier's disease) (Rogers *et al*., 1997). In addition, a strong association exists between osteophytes and osteoarthritis (Moskowitz an Goldberg, 1987). Furthermore, osteophyes may form as a result of imposed mechanical load on the back (Kim *et al*., 2012). Some of that make us able to infer that this adult female involved in behavioral activities during she imposed mechanical stress on her vertebral column such carrying heavy objects.

Dental caries

The adult female skeleton had displayed dental caries on the second lower molar (see Fig. 11). Rate of dental caries is a very informative indicator on the health of human teeth and can be used to reconstruct dietary habits among archaeological populations (Limbo, 2013).

Newbrun (1982) and Larsen (1982) defined dental caries as demineralization of hard structures of teeth as a result of action of acidic materials from specific species of bacteria associated carbohydrates rich foods. A close link was established between the type of diet among archaeological populations and dental caries. To understand the pattern of change in prevalence and frequency of dental caries, several studies were conducted on different archaeological populations depended on different subsistence practices. In a very recent published study, Limo (2013) studied the frequency , location, and severity of the dental caries of 5838 teeth from six Estonian archaeological populations dated back to Migration period (450 -600 AD) and Early Modern Times (18th. c.). Her study showed a gradual increase in frequency and degree of severity from Migration Period to Early Modern Period. In another study conducted on skeletal remains from Georgia Bight, Larsen *et al*., (1991) showed a

pattern of increase in the frequency of this type of dental disease few centuries pre-European contact as a result of intensification of maize agriculture.

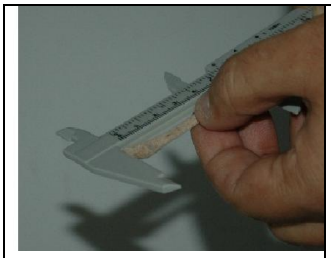		
Fig. 9. Measuring length of a long bone to estimate age for the fetus.	**Fig. 10. Mild degree of the osteophytes (Lipping) on the upper rim of one of the thoracic vertebra.**	**Fig. 11. Dental caries on the second molar of the adult female skeleton.**

Investigation and Analysis

1 - Soil pH test result:

Since the preservation condition of the skeletons in the tomb was very good, it was necessary to monitor soil pH value. In order to do so, four soil samples were taken from the skeletons (One sample from each skeleton and one from soil) during procedure of cleaning. Two grams of each sample was immersed in a known volume of freshly prepared distilled water (10 ml) for one hour, after that the pH electrode was immersed in the water, and then the pH value reported.

pH value for bone and soil samples was (7.4) , which represents the mean value of 3 readings for each sample (7.4 – 7.6) . We conclude that the cause of bones preservation for the long period of time in the burial environment is due to its presence in a balanced suitable environment, where it is known as a protective for bones than the acidic ones, which cause significant deterioration for the bones (Abdel-Maksoud and Abdel-Hady, 2011).

2. X-ray Diffraction (XRD)

Two XRDs were conducted; one for one of the adult skeleton and one for the soil (See Figs. 12 and 13). The findings indicated for the presence of Gypsum and Quartz, which led us to conclude that the soil was humid. ($CaSO_4.2H_2O$). Based on these results, we conducted the XRF in order to examine if the Sulfate is present or not.

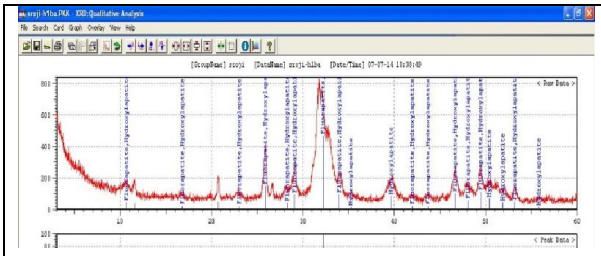

Fig. 12. XRD for bone

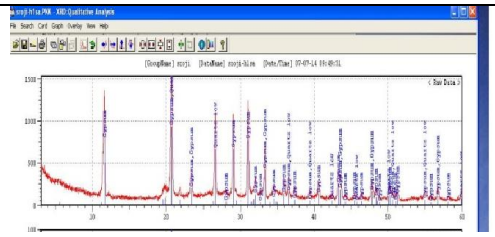

Fig. 13. XRD for the soil

3. Fourier transform infrared spectroscopy (FTIR) and X- ray Flourescence (XRF)

Fourier transform infrared spectroscopy (FTIR) was performed on the adult skeleton (Fig. 14). The results showed the presence of the peak of absorption at (565 cm^{-1}, 605 cm^{-1}, and 595 cm^{-1}) indicated that hydroxyapatite did not change. In addition, the skeletons was in a good condition.

The peak of absorption at 872 cm^{-1} indicated for the presence of Calcite ($CaCo_3$) in the bone. X- ray flourescence (XRF) was conducted on a soil sample (See Fig. 15). One of the important results of XRF is the presence of Sulfate.

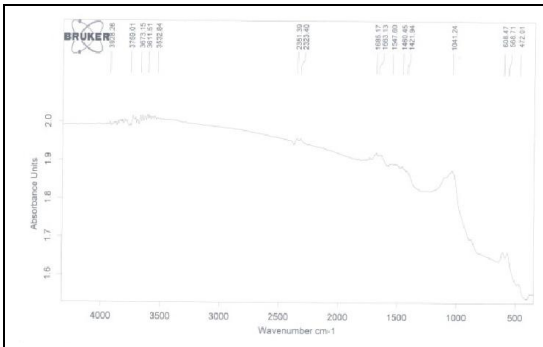

Fig. 14. FTIR for bone

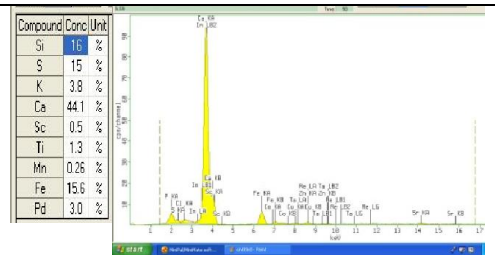

Fig. 15. XRF for the soil

Treatment and Conservation

1. The cleaning process

Because of the presence of hard dirt on the skeletons and in order to examine many of their parts for sexing and aging and diagnosing diseases, this procedure was inevitable. We started the mechanical cleaning for bone with light brushes and dental tools. But for very hard dirt, we used chemical methods by using water and alcohol or acetones (the use of alcohol and acetone will facilitate object drying). In order to remove the rest of hard dirt, a combination of both mechanical and chemical methods

was employed. To soften some of the dirt using a chemical method, we used water and alcohol and after that, we removed it mechanically by brushes and scalpels (Plenderleith, 1979) (See Figs. 16 to 33).

After bone fragments were cleaned, they were laid out on a table in order to dry slowly. After that, they were covered with a polyethylene sheet to reduce the evaporation rate and to prevent development of cracks or occurrence of other physical changes.

Fig. 16. Sacrum of the adult female before cleaning

Fig. 17. Mechanical cleaning of part of the sacrum

Fig. 18. Wet cleaning on part of the sacrum

Fig. 19. Drying the sacrum of the adult skeleton

Fig. 20. Humeri of adult skeleton before and during mechanical cleaning

Fig. 21. Humerus of adult skeleton after cleaning

Fig. 22. An ilium with dirt on it

Fig. 23. An ilium during cleaning

Fig. 24. An ilium after cleaning

		
Fig. 25. The hipbone of the adult skeleton with a lot of dirty on it.	**Fig. 26. The hipbone of the adult skeleton during mechanical cleaning**	**Fig. 27. The hipbone of the adult skeleton during cleaning**
		
Fig. 28. Part of the adult skeleton lower jaw with a lot of dirt on it	**Fig. 29. Part of the adult skeleton lower jaw during cleaning**	**Fig. 30. Part of the adult skeleton lower jaw after cleaning**
		
Fig. 31. Bone fragments of adult skeleton with dirt on them	**Fig. 32. Bone fragments of adult skeleton after removing the dirt**	**Fig. 33. Mandible of the infant.**

. Gluing the broken parts[٢]

After experimental study on bone samples to choose the best concentration of the adhesive that will be used, and after looking at previous experimental studies by specialized conservators in the field of bone conservation, a thick viscous mixture of Paraloid B-72 dissolved in acetone (20 % concentration) was used to glue the broken parts. A small fragment of the lower right side of the adult female sacrum was glued

with the bigger part. Another glued parts were fragments of the ilium of left hip bone (see Figs. 34 to 39).

		
Fig. 34. Broken sacrum of the adult skeleton	**Fig. 35. Gluing the sacrum by Paraloid B-72 dissolved in acetone (20% concentration**	**Fig. 36. Sacrum of the adult skeleton after gluing.**
		
Fig. 37. Broken Iliac part of the hipbone	**Fig. 38. Gluing the fragments of the ilium**	**Fig. 39. After gluing the iliac fragments**

3. Consolidation and coating of the bones

After bones cleaning, we slowly drying them by organic solvents (acetone), then a 3% solution of paraloid B - 72 was used for bone consolidation. We applied the a light layer of resin by brush. After the first layer dried, we applied a second layer of resin (5 % Soultion of paraloid B-72) to get sufficient absorption of the resin by the object to accomplish consolidation (See Fig 40 to 42).

		

Fig. 40. Consolidation of one of the verterbrae of adult skeleton	Fig. 41. Consolidation and coating the sacrum of the adult skeleton	Fig. 42. Consolidation and coating of some of the bone fragments of the adult skeleton

Discussion

These three skeletons were unearthed buried in a big jar and dated back to Early Iron Age. Different scenarios will be discussed on the way they were buried and the rituals associated with their death.

The first possibly practiced burial habit type was a primary type, in which the three individuals of the same nuclear family buried in the jar. An evidence that might indicate to that, that the opening of the jar was broken to allow them to put the bodies of their dead people inside it.

The second possible scenario that this type of burial habits is a secondary type, since that the population lived in Sahab at that period of time buried their dead in the ground, and after the flesh decomposed, they brought the skeletal remains and reburied them in the big Jars. It might be that the three skeletons were for individuals belonged to one nuclear family, a mother with her fetus and infant.

The possible cause of death that they mother who was in her early thirties was in the second trimester of her pregnancy and had an abortion associated with severe bleeding that led to her death.

As predicted by value of pH , the preservation was very good. As a result of that, the condition of the skeletal remains was very good. Furthermore, several methods of cleaning were performed in order to remove the dirt and other materials from the skeletons.

Conclusion and Recommendations

The findings of this research paper enable us to reach the following conclusion; dead individuals of the same nuclear family were buried together in primary or secondary burial tomb or jar.

Another an ongoing study is on the skeletons found in a second Jar unearthed from the same archaeological site. Dating using Carbon - 14 and genetic study will be conducted in order to find out the relation between those individuals.

Acknowledgments

First of all, we would like to thank Professor Abudulla Al Shorman for his assistance. We would like to thank Hadeel Nawasreh, an undergradute conservation and cultural resources management student for her efforts in the laboratory. In addition, we send our great thanks to Mr. Mahmoud Abu Dalou, a store staff member. We thanks also Sana' Khasawneh, a staff member of the laboratory unit of the faculty of archaeology and anthropology.

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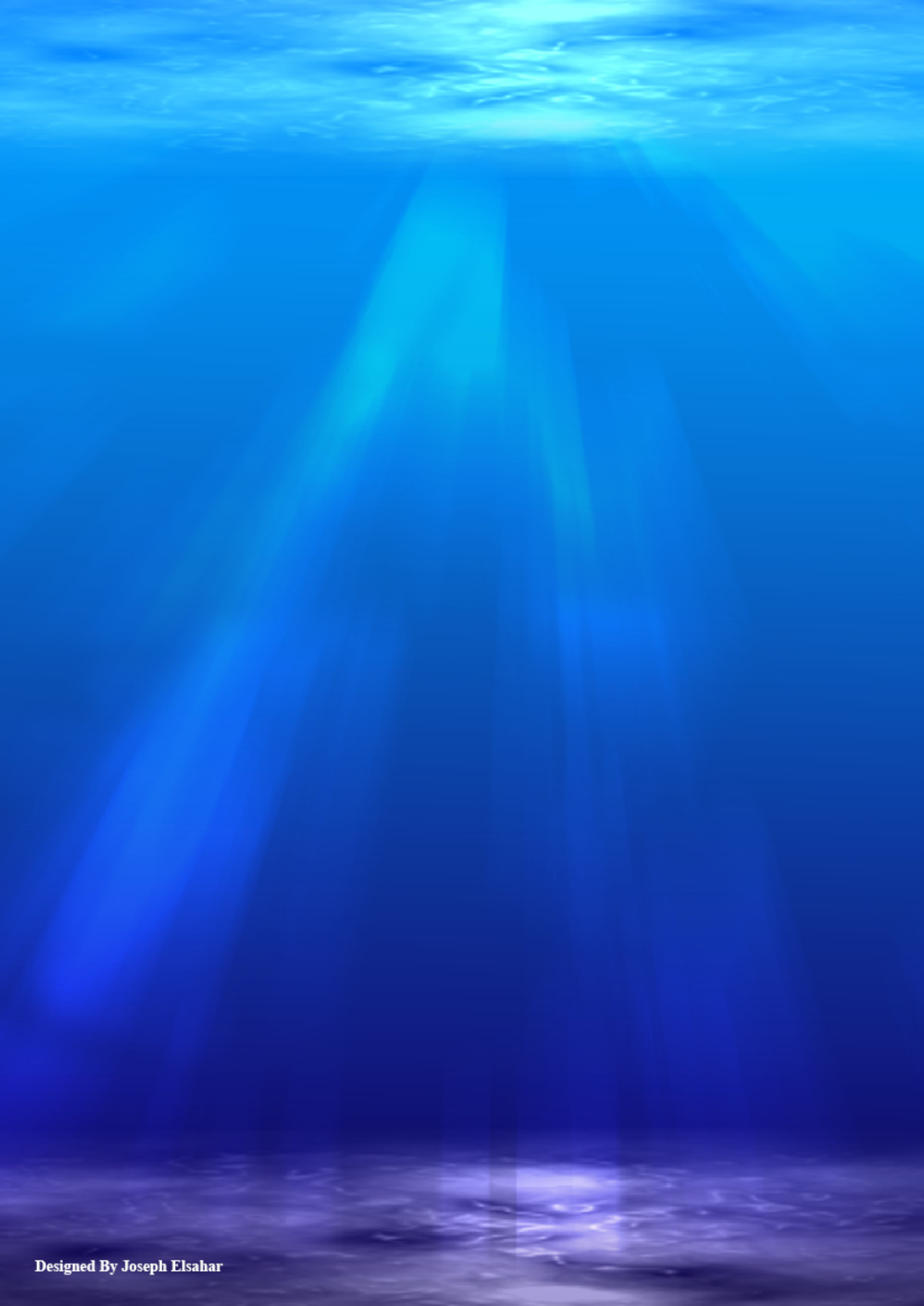
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