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MODERN DIRECTIONS IN ARCHAEOLOGY, A STUDY OF THE SUPPORTING HUMANITIES AND APPLIED SCIENCES

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Abstract

At its beginning, archeology was a description of stone buildings and huge tombs that remained visible above the ground and resisted the elements of nature. Then it became a distinct science that relied on all possible documents without limitation and benefited from the methods and data of most sciences. There has been a shift in the development of archeology in the last twenty years, and an intellectual and methodological division occurred in the subject of archaeology between a traditional archaeological school and a modern method. In the past, archeology relied on classifying and classifying discovered objects and bringing them together.

After the discovery of absolute modern dating methods, the archaeologist has a powerful weapon with which to address the problem of determining the time of things, which is one of the most important goals of research and excavation.

Archeology also benefited from new elements in the field of physical and natural sciences, such as botany, zoology, and ecology, and such sciences became an important tool for interpreting archaeological problems, such as knowledge of the development of agriculture, the beginning of animal hybridization, and differences in the natural climate and its developments over previous times.

As a result of this, auxiliary sciences emerged to uncover antiquities or treasures buried in the ground without resorting to manual digging. The auxiliary sciences for archeology have an effective role in the field of studying man and his civilization, including human sciences and applied laboratory sciences, and these sciences cooperate with archaeology. In order to obtain comprehensive information about humans and their civilizations in various parts of the earth.

The archaeological researcher should be familiar with the sciences ancillary to archaeology, which help the researcher in interpreting and establishing phenomena. The

ancillary sciences can be classified into several categories within the field of historical and human sciences, environmental geographic sciences, mathematical sciences, and artistic and technical knowledge.

Keywords: archaeology, archaeologist, physical and natural sciences, applied laboratory sciences, historical and human sciences, environmental geographical sciences, mathematical sciences, artistic and technical knowledge.

Introduction: Archeology

Archeology is the science of studying human civilization, as its goals are to document and clarify the origins, understand the history of culture, record cultural developments, and study human behavior and the environment. It is concerned with studying the material things that man has left behind, starting with the tools that he made from raw materials to meet the requirements of life in terms of livelihood. And dwellings and other things, based on the fact that these tools remain after him an indication of his experience and the history of his era.

Archeology seeks to provide the scientific material on which the history of art is based by refuting this material, classifying it, and extracting the foundations, theories, and various stages of development. It is the study of man's civilizational path through analyzing and interpreting the material remains extracted from archaeological sites, where archaeologists conduct field surveys and excavations. By detecting and analyzing these remains[1].

The Arabs were credited with studies of archeology and art history, including the expeditions sent by Caliph Al-Wathiq to explore the coast of the Caspian Sea, the Dam of Gog and Magog (the Wall of China, as they believed), and the city of Al-Raqim. In the Abbasid, Fatimid, Ayyubid, and Mamluk eras, they also had a type of museum in which they preserved historical antiquities. There are some Arab historical works that have clear archaeological and descriptive value, such as the Book of Idols by IbnHisham al-Kalbi and the Book of the Crown by al-Hamdani. Abd al-Latif al-Baghdadi is considered the first Arab archaeologist, and specialized in the history of arts. Among the travellers, geographers and historians are IbnKhurdadhabh, Al-Yaqoubi, IbnRusta, Al-Masudi, IbnHawqal, Yaqut Al-Hamwi, Al-Harawi, IbnJubair, IbnFadlallah Al-Amri, Ibn Battuta, and Al-Qalqashandi.

As for archeology and art history in the Western world, Homer, the famous Greek poet, is

mentioned as the oldest specialist in the history of art and archaeology. Among the first were the Greek Tocidides, as well as Herodotus, Pausanias, Xenophon, Strabo, Vitruvius, and Plinus. The study of art history became widespread in Europe, and we mention among the specialists in this field Grutter, Jack Spohn, Barthelme, Wood, Dawkins, Johann Joachim Winckelmann, von Stackelberg, and Lord Elgin.

Archeology and art history in the nineteenth century were associated with the pursuit of adventure, national or personal glory, espionage, and international conflict. These include Burckhardt, Paul-Emile Botha, Victor Place, Henri Layard, Ernest Renan, Melchior Dovoge, Heinrich Schliemann, Sarzek, Flinders Petrie, Max von Oppenheim, Wigand, Carter, Carnavon, MortimoreHüyler, Leonard Woolley, Jordaan, Noldeke, and Heinrich Wilson[1].

As for the relationship between studies of modern archeology and art history, the Romans in ancient times admired Greek antiquities, and in the European Renaissance, material waste became symbols of an ideal life that society aimed to revive and live in. In the Age of Enlightenment, archeology got rid of superstitious and idealistic theories, and became of historical significance. As for the Arabs, they used to call ancient wastes whose origins they did not know “Al-'Adiyat,” in reference to the defunct 'Aad tribe.

Archaeologists study any evidence that can help them understand the lives of people who lived in ancient times. The archaeological evidence ranges from the remains of a large city to a few pieces of stone, left by someone who was making stone tools long ago. They also follow three steps in interpreting the evidence they find to lay the foundations of art history through classification, dating, study, and analysis[2].

Ancillary sciences to archaeology

The current trend in archaeology seeks, therefore, to establish methodological foundations for multi-faceted archaeological research[4] that involves a number of sciences and techniques. This means that the archaeologist, when he begins to address his archaeological material or problem, must look at it from the entire framework of human life, whether from In terms of the geographical topography of the area inhabited, or in terms of its natural resources of water, plants, animals, minerals, etc., or in terms of climate and erosion phenomena. This view, of course, requires the collaboration of many sciences and specializations when examining the archaeological problem[3].

Regarding the recent trend of science in uncovering antiquities that are still preserved in the ground, we know that antiquities researchers were and are still relying entirely on manual excavation work, despite the difficulty and hardship involved in this excavation, and the matter remained this way until the trend... Some of these researchers recently turned to modern science to help them and facilitate their work and save their effort, time and money. They focused on places where devices could indicate the possibility of the presence of traces. This trend has occurred since the last century when science directed its research and studies to intangible matters, especially electromagnetic waves and X-rays. And universalism, and others, in constant attempts to make practical use of them, and he has undoubtedly achieved many achievements in this regard.

As a result of this, auxiliary sciences emerged to uncover antiquities or treasures buried in the ground without resorting to manual digging. The auxiliary sciences for archeology have an effective role in the field of studying man and his civilization, including human sciences and applied laboratory sciences, and these sciences cooperate with archaeology. In order to obtain comprehensive information about humans and their civilizations in various parts of the earth.

The archaeological researcher should be familiar with the sciences ancillary to archaeology, which help the researcher in interpreting and establishing phenomena. The ancillary sciences can be classified into several categories within the field of historical and human sciences, environmental geographic sciences, mathematical sciences, and artistic and technical knowledge.

In any case, it is not possible to limit the sciences that help archaeology. An archaeologist, like a surgeon, is competent in all sciences and his work improves with the development of techniques. In this regard, it can be said that human biology is one of the sciences that provides clear services to archaeological research, in terms of its study of ancient bones and mummies and knowing the ages of the dead. The physical characteristics, diseases they suffered, and ancient medicine methods.

Ancillary sciences can be classified into several categories within the field of environmental geographic sciences, historical and human sciences, mathematical sciences, and artistic and technical knowledge, the most important of which are as follows:

1. Anthropology and Ethnology

Anthropology[5] and ethnology [6], like history, are among the auxiliary specializations

most closely related to archaeology. The first investigates the natural historical development of man, and the second investigates his cultures, customs, and traditions. Therefore, some scholars see them as historical and therefore archaeological research.

At the forefront of these sciences is the science of "anthropology,"[7], [8] and perhaps the best definition of this science is what was written by the American researcher Margaret Med. She says: We describe the biological and cultural human characteristics of the human species across time and in all places, and we describe and analyze the local biological and cultural characteristics as patterns. Interconnected and changing, through advanced models, standards, and approaches. We are also interested in describing and analyzing social and technological systems. We also mean researching human mental perception, innovation, beliefs, and means of communication.

This reveals the American concept of the fields of anthropology, which from their point of view means the study of both biological and cultural aspects. Americans use the term biological anthropology to refer to the study of the organic or vital aspect of man, while they use the term cultural anthropology[9] to express the study of The social and cultural aspects of man, and everything related to ancient human civilizations is included within its scope, which is the field of archaeology. Therefore, archaeology in its content is part of cultural anthropology, and the science of studying ancient languages (Philology) falls within the same scope[10].

Within the framework of cultural anthropology - according to the American concept - there are two equally important fields of study: (Ethnography)[11], which means a descriptive study of the lifestyles, customs, traditions, religious values, and arts of a specific group or people during a specific time period[14], and Ethnology, which is the field that is concerned with Through analytical and deductive study of all other subjects of the ethnographic study. While the European concept of anthropology and its fields differs from the American concept, the European concept is limited to the fact that anthropology refers to the fields of human natural history and human races, sex and species, anatomical characteristics and biological processes, and the relationship of this to determining the functions and social roles of each species[15].

In view of these complexities of the concept of anthropology, its meaning gradually became limited to the science of studying human races from a natural perspective, which is in line with the European concept. Despite this, it is possible to benefit from the science of

anthropology in the field of archaeology through human skeletons and identifying human races. Or the races of the archaeological finds. The gender, age, and condition of the owner of the skeleton can also be determined through anthropological study[16].

The science of ancient archeology (excavations) is specifically concerned with collecting antiquities and human remains and analyzing them, in order to infer from them the historical sequence of human races, in that period in which there was no writing, and there are no recorded (written) documents about them.

This branch of cultural anthropology investigates the early origins of human cultures, especially extinct cultures. Perhaps ancient archeology is more common among the branches of anthropology, and its discoveries may be more familiar to the average person than those of other branches. For example, the name of (Tut ankh amun), one of the ancient Egyptian kings, is almost unknown to the general public[17].

Although the primary goal of this research is to obtain information about ancient peoples, the ultimate goal is to help readers and scholars understand the processes related to the growth, prosperity, or collapse of cultures or civilizations, and thus understand the factors responsible for those changes. It is known to anthropologists that writing appeared about four thousand years BC, and what was written from that date is known to scholars and researchers, and through these written traces it is possible to learn a lot about man[18].

In his study, the archaeologist relies on the remains left by ancient man, which represent the nature of his cultures and their elements. Archaeologists have developed precise methods for excavating the layers of earth in which cultural remains are expected. They also came up with precise methods to examine these remains, determine their locations, classify them in order to identify them, and then compare them with each other. Using these methods, archaeologists can extract a lot of information about ancient cultures, their changes, and the relationship of each of them to others.

Anthropologists use material remains as main data for using scientific and theoretical knowledge, as archaeologists analyze cultural models and the developments that occurred in them, so the waste reveals conditions of consumption and activities.

Wild grains and domestic grains, for example, have different characteristics that allow archaeologists to distinguish between a plant that was brought in and one that was cared for locally. Examination of animal bones also reveals the ages of these animals that were slaughtered, and provides other useful information that determines whether these species

were wild or domesticated. Through their research into this information, archaeologists reconstruct models of production, trade, and consumption[3].

Although the clear immediate goal of (archaeological) research is to complete our knowledge and information about the human past, the ultimate goal is to help us understand the processes related to the growth, prosperity, and collapse of civilizations, and to realize the factors responsible for these historical phenomena. The results of archaeological studies related to evolutionary processes have become familiar to all anthropologists who study the phenomena of cultural change[17].

Therefore, archaeologists - anthropologists - resort to benefiting from the research of geologists and climate scientists, to verify the (identity) of the remains they discover, and the history of their existence. Archaeologists also cooperate with specialists in natural anthropology, due to the large presence of human finds in excavations, along with cultural remains. Modern archaeologists have succeeded in using radiocarbon dating as a means to accurately determine the age of remains[19].

t can be said - in general - that ancient archaeologists are trying to discover that part of past history that is not covered by written records, and the ancient archaeologist embraces his field of specialization with enthusiasm, because his work is associated with a set of tempting motives and stimuli, such as the desire to conduct interesting scientific research, And the possibility of finding valuable treasures[17].

Archeology, then, studies the history of man and the cultural changes that accompanied it, in an attempt to build a complete picture of the social life lived by ancient societies, prehistoric societies, and if archeology depends - to some extent on history - then it differs from the science of history in that it He does not study the historical stages of civilization, but rather studies those periods that human society lived through before the invention of writing and the recording of history

2. Sociology

When studying a site or region, archaeologists try to identify the nature of the society that lived in it by extracting information from studying the discovered archaeological material[20]. For example, the nature and area of the buildings on the site indicate that there was evidence of the existence of a ruling class and an organized society. If a building is found that can be described as a temple, it indicates to us that the people worshiped a god and practiced religious rituals. Likewise, if we want to learn about burial customs, we

study them. Through archaeological excavations in ancient cemeteries.

As for the importance of archeology in relation to sociology: Before beginning to explain the importance of archeology in sociology, we must point out the existence of a complementary relationship between three sciences: archaeology, history, and sociology. Historiography and sociology are provided with or rely mainly on archeology to provide them with the required information.

Its connection to the science of history is evident in the facts that archeology provides about groups in historical eras that left their traces in the form of written texts, artistic or architectural artifacts, and ancient manuscripts. The historian cannot confront the past directly alone, but rather confronts it through the monuments and texts left by man. Archeology is the science that depends on collecting these remains and analyzing them to discover the truth about the past. It becomes clear to us that the work of the archaeologist is not limited to discovering the effects of former nations, but rather analyzing what is revealed, for example; If there are remains of burning on the floor of one of the discovered buildings, this may indicate the presence of a hearth in this place, or if many skeletons are found, this is an indication of the presence of a cemetery in the place, and the large number of pottery fragments and pottery in the site along with the presence of fossilized grain remains. It may indicate that the place was a grain storehouse, and so on.

It can be said that everything that was mentioned about the role of history in a science is directly linked to archaeology, and in order for the relationship of archeology to sociology to become clear, the following points must be mentioned:

- IbnKhaldun (the founder of sociology) took history as a science that is studied, not just a narrative that is written down, and he wrote history in the light of a new method of explanation and analysis. His contemplation and study led to the development of a kind of social philosophy, and he gave history a social definition, where he says: History aims to Our understanding of the social condition of man (civilization), and the phenomena associated with this civilization, and the knowledge of primitive life, the refinement of morals, and the spirit of the family and tribe.

One of the goals of sociology is to study the social facts and phenomena of society in order to identify their elements in order to know the general principles of social life.

One of the goals of sociology is to study the origin of social phenomena, the developments they have undergone over the ages, and the factors that led to and helped this development.

One of the goals of sociology is also to identify the extent of interaction that occurs between individuals and groups.

- The mutual dependence between history and sociology represents the interdependence that characterizes human action, as it is a social action and a historical action at the same time. Thus, history derives from sociology theoretical principles, concepts, and perceptions, to use them as tools for historical research, and sociology, in turn, derives from history the material that helps it in Understanding current social conditions.

From the above it is clear to us that what is revealed during archaeological excavations and the analyzes provided by archaeologists serve as the cornerstone from which the historian begins to write about an era, and the starting point for the sociologist when he searches for the nature of society in a civilization or era, and how It was the relationship between members of society, and then presents the reasons and motivations behind the spread of a certain social phenomenon in previous eras, and also the careful study of ancient society has an effective role in avoiding many of the mistakes committed previously, thus contributing to developing solutions to societal problems.

For example, when studying one of the ancient epics or myths that are uncovered with prospectors' shovels, we can analyze the society at that time, by extracting the most important values, social phenomena, and human attitudes, and the interaction of individuals with each other, and learning about the political, economic, and social life of that society, and the motives behind writing these texts, and the concerns and ideas that occupied society at that time[3].

3. Geography

Historical Geography

Since the end of the last century, historical geography has imposed itself as a stand-alone specialty capable of opening new horizons for research into the history of the ancient and medieval eras, and deepening knowledge regarding a number of historical phenomena associated with these two eras. Attention continued to increase among specialists after that to the importance of human interaction in the field and addressing the mutual influences between geography and history in developing historical knowledge, to the extent that some did not hesitate to acknowledge that ancient and medieval history begins with historical geography[21].

The relationship between geography and history imposes influence and influence between

the two sciences. The emergence of historical geography was accompanied by the emergence of geographical history or coincided with it. With the development of sciences and their openness, it became necessary to approach specializations, and this is what happened between history and geography. Accordingly, the study of all disciplines that are useful in historical writing It helps to acquire a research methodology and we feel that it is right to delve into its study.

Historical geography can be defined as the geography of the past over time. Historical geography tries to give us a picture of the components of the field, its development over time, and its dynamism. The geographical field is exposed to changes with time, and this is what makes humans interact with this change. Therefore, the human factor cannot be isolated from the field that Man lives in it, as man is the son of his environment, and historical geography attempts to study all the changes occurring in the field and link them to the temporal factor, which is considered one of the foundations of historical research. Thanks to this openness to time, historical geography has achieved remarkable development, and therefore it is correct to say that any human or natural geographical phenomenon that appeared in history and developed Its present appearance is merely a link in a continuous chain that derives its existence and meaning from the past[3].

Some researchers have said that historical geography has added new things to historical and geographical research, as it attempts to reveal the types of urbanization, how it was distributed, the type of activity and the distribution of population there. We see this in the change that occurs in the field, that is, the Earth, when earthquakes, volcanoes, hurricanes, and cases of water inundation occur in several regions and geographical areas that were populated. This does not appear to the average person and he cannot record it, because the human lifespan is too short for this change to appear. The change that occurs in a slow manner, which does not become apparent until after generations, while the change in the cultural appearance or human civilization does not require evidence of its existence. The establishment of reservoirs and dams on riverbeds, which control the water of the riverbeds, is such that humans cannot benefit from them in agricultural operations. And the rest of his life activities, and among the cultural manifestations is the establishment of villages and cities, and these are all things recorded by history and witnessed with our own eyes throughout the globe[22].

Therefore, geography is the science that studies the earth as a homeland for man, and

therefore studying the field in its connection with time gives a qualitative addition to the study, and this is what historical geography benefited from. Carl Ritter[23], [24], [25], during his life, was a strong believer in the relationship between geography and history, while Halford Mackinder[26] is considered one of the founders of historical geography, not only in Britain but in the world, and it captured most of his attention, so that he defines it as the study of the historical present. He adds, saying: The geographer must return himself to what existed a thousand years ago, or two thousand years ago, or more, and he must try to imagine The geographical conditions that existed at that time were as if he were experiencing them at that particular stage.

We find many researchers focusing on some of the basics of studying historical geography. Gilbert Fowler White[27] draws attention to five points for this study:

- Study the history of geography.
- Study the history of geographical discoveries.
- Study of changing political borders between countries.
- Study the impact of the environment on the course of historical events.
- Study of the regional geography of the past.

Hence, geography, according to many previous definitions, is the development of the relationship between man and the environment over time, and it is the study of what the geography of a place, region, or site was like in a specific period in the heritage of history, and what distinguishes historical geography from other topics of geography is the addition of the element of time.

The student of historical geography has the task of reconstructing the previous geographies of the geographical area under study, stressing that it is concerned with studying historical development and various population movements[28], and this requires the geographer to be familiar with the geographical, geological and historical heritage of the past, to raise questions such as why the region is in this state and whether its appearance will change with time. If the controlling mechanism changes.

The logic of spatial history (historical geography) is included within the means and tools of historical analysis, because the field is the first witness to the existence of man and that the presence of the latter affected the field and began making history. This hypothesis was built on archaeological, geographical and anthropological data.

Hence, everyone agrees that historical geography is part of human geography, and studies

the human relationship with the field and opens up about the subject of past time and the changes taking place in the field over time.

As for the relationship between history and geography, it is known that geography is a science that studies the earth and the natural and human phenomena that occur in the field and is divided into three sections: human geography, natural geography, and regional geography, while history is the study of man's relationship with the field in the past time, and its study of the human past is what distinguishes it from the rest. the sciences.

Thus, both geography and history come together in the study of the field and man, that is, man's relationship with the field. Geography tends to the field through description, and history tends to man by tracing the minutest details of his life. But history goes beyond geography when it attaches great importance to time. Rather, the core of historical study lies in knowing the past time. As for geography, it does not pay attention to time. However, the development that occurred with the Vidal school with Paul Vidal de La Blach[29] liberated geography and produced A new branch is called historical geography, and thus historical geography is a valuable subject for historical studies because it analyzes the past of a geographical location, to then make it easier for the historian to understand the cultural and civilizational developments taking place in the field while writing history. The use of historical geography has become increasingly urgent for the historian.

The strong mutual relationship between geography, which represents the science of place, and history, which represents the science of time, is a very old topic that has occupied human thought since it became interested in studying the nature of human society on the surface of the Earth. The reality is that the factors of space and time cannot be separated from each other, just as history cannot be separated. And geography. Many have realized this relationship between geography and history, and Jules Michelet[30], [31] says: Without a geographical basis, it seems to us that the people who make history are as if they were walking in the air, that is, without a basis. Place has an influence that is manifested in many forms, such as food and climate, and it affects... Human groups also affect individuals.

Hence, the close connection of geography with history is based on a strong and inseparable relationship, and that history is an ancient geography, and historical geography is distinguished by the addition of the element of time, which is one of the characteristics of history, which gave it a dynamic dimension. The element of time gives historical

geography the ease of sequential and analytical linking within the spatial framework, so that The past is the key to the present on the one hand, and adopting the current cultural appearance or the prevailing natural appearance to build historical geography from which the origin of things can be reached on the other hand, and historical geography has become a science in which historical facts are formulated in a geographical manner.

As for the duality of time and place in historical geography, as previously mentioned, historical geography is a branch of geography, the latter of which pays great attention to the field (territory - place), so that it forms a pillar in geographical research, in general, which makes historical geography useful. By giving dynamism to the field, which is mixed in the study with past time. For example, the Earth has changed at the present time compared to the beginning of its origin and formation, and this change has taken a different form with the passage of time. Time, when its study is respected, moves us from the superficial study of the field to the deep study that monitors the development of this field. The field across time, which requires geographers to stop, correct the course, and think about writing geography in its temporal dimension, which benefits geographical research, and since historical geography solves our geographical problems such as duality and planning the future, this is why it can be said that the future of geography is historical geography.

Historical geography recognizes that location is not only an absolute idea, but it is relative because it is a geographical factor that is variable and constant at the same time. Since it is variable, a correct evaluation must be made during the different eras of history, and whenever a place changes, negatively or positively, that place takes on another dimension depending on the nature of the change, and thus the features of the site are what determine the spatial relationship with other sites.

Historical geography benefited greatly when it added the temporal factor. This prompts many researchers to acknowledge that the only difference that distinguishes historical geography from any other geographical study is the addition of the element of time, an element that is mostly absent from general geographical study. The Annales School benefited from giving importance to geographical location at the expense of political events. Let us mention FernandBraudel, who revolutionized historical writing[32], [33], [34].

It freed geography from tracking current facts, which constitute its sole concern, or almost,

and forced it to exploit its methods and spirit to rethink past facts. It made traditional historical geography a truly humane geography interested in the past. It forced geographers to pay more attention to time (something that may It is not relatively easy. Historians must pay more attention to place (which may be more embarrassing for them), and he thinks about the dialectic of time and place to imagine multiple times. This is how we arrived at dismantling history into levels in the form of shelves, or, if we like, distinguishing between time. Geography, social time, and individual time.

Just as history benefited from the field and the pioneers of the Annales School produced what is called geographical history, the Federalist school contributed greatly to the emergence of historical geography. The latter, by adding the temporal factor, had achieved a qualitative breakthrough in geographical research. The duality of field and time in historical geography increases the cohesion of history. Geography opens up various horizons for research in historical or even geographical studies.

Adopting the field in historical study and interpretation is considered a qualitative addition to the science of history, which cannot be separated from geography. It is true that history is superior to geography by the factor of time, which adds dynamism to geography if it is benefited from, and this is what we observe in historical geography.

Therefore, historical geography is not one of the branches of physical geography or human geography, but rather it is the geography of the past with its natural and human aspects, meaning that it is not limited in its study to the natural conditions of the past, but rather is interested in studying human activity as well, and this does not prevent there from being studies on geography. Climate in the past, or studies on human migrations, and in summary, historical geography includes both aspects of natural and human geography to make them one science, the subject of which is the geography of previous eras, and from here it gained the name historical.

Historical geography derives its material from several sciences. It is closely related to other branches of geography, especially geomorphology, climatic geography, and biogeography, in addition to human geography in its various branches. Historical geography uses paleoclimatology to identify the climatic conditions that prevailed in regions of the world in The different eras, especially the Pleistocene era, and historical geography has a close relationship with archaeology, as the student of historical geography resorts to the effects left by man. Through what ancient societies left behind, archaeologists are able to collect

evidence that is useful to the student of historical geography. Among the other sciences is anthropology.) in both its natural and cultural parts, and it benefits historical geography in identifying different civilizations, and how they fit, continue, or change.

Historical geography is concerned with linguistics. Through linguistic analysis, the student of historical geography is able to learn about humans in different historical periods, as language is a means of preserving civilization and transmitting it from one generation to another. There is no doubt that the relationship is close between historical geography and the science of history.

Geographic information systems

Archeology has been associated with a large number of modern sciences that archaeologists have used in order to facilitate their work, save time and effort, and enhance their research activity. One of the most famous of these sciences is the geographic information system, which has become one of the important tools used in documenting and managing archaeological sites, due to its great ability to monitor, document, analyze, display, and other capabilities required by archaeological documentation processes.

Geographic Information System (GIS) is the science that is concerned with collecting, processing and studying geographical information, and it is considered a special case of the information system that contains databases that depend on studying the spatial distribution of phenomena, activities and goals that can be identified in the spatial environment, such as points, lines and areas. This system processes the data associated with those points, lines, or areas to make the data ready to be retrieved, in order to analyze it or inquire about specific data through it [35].

The geographic information system is considered one of the main components of geomatics, which includes all sciences and technologies related to urban data in its digital form, including urban surveys and spatial information systems.

Origins and applications

The beginning of the emergence of the geographic information system was by chance, as it appeared in London in 1854 AD when it was suffering from an outbreak of cholera, and there was no way to determine the places where the disease was spreading, until the scientist John Snow was able to use some representative points for specific locations suffering from the disease, which It made it possible to determine the source of the epidemic, so a map was drawn that identified the places where the disease spread more

widely.

At the beginning of the twentieth century, the concept of maps was developed to become a group of slices or layers separated from each other, with each layer fed with a number of information. The English geographer Roger F. Tomlinson (1933-2004) is considered the owner of the basic idea of this science, so he is called the godfather of this science.

Data processing and analysis

The idea of a geographic information system is based on collecting, entering, processing, analyzing, displaying, and outputting spatial and descriptive information for specific goals. It consists of several stages: the first is the data storage and retrieval stage; It consists of entering and storing geographical data from various sources, including maps, digital and descriptive data, while linking them together to make it easy to recall them in the form of layers when needed.

The second stage is the data processing and analysis stage. Where a change is made in the type and level of data, entry errors are removed, and data is updated, in addition to performing some statistical and mathematical operations such as determining areas, distances, and ranges of urban areas. The final stage is the data display and presentation stage, which consists of displaying all or some of the original data in the database in different styles, either on a computer screen or on paper in the form of maps, reports, and graphs.

Components of a geographic information system

The system consists of a set of basic components, the most important of which is data, which is the basic element of this system. This data is spatial and descriptive, and is obtained using several modern techniques, such as aerial photography, remote sensing, and GPS. The second component is the availability of modern computers that accept application programs that run on this system, as well as programs that analyze and process data stored in databases. Data is stored in more than one layer to overcome technical problems resulting from processing large amounts of information at once. The most important of these components is the human element that is well trained and qualified to use these programs.

This system has many advantages, including its superior ability to link different data in large databases and to conduct searches in these databases, which helps in conducting various studies to produce the required results in a complete, accurate and simplified

picture, as better data leads to a better decision. This system is considered an important tool for inquiry and analysis, especially for decision makers, as it helps them make the best decisions very quickly and with high effectiveness.

Another advantage of the system is that it helps document and confirm data and information with unified specifications, disseminate this information to the largest number of beneficiaries, and coordinate between the information and relevant parties before making a decision. It is also very useful in conducting simulations of new proposals and planning projects and studying the results before actual implementation. .

The role of geographic information systems in the fields of archaeology

The use of the geographic information analysis tool (GIS) is useful in scientific research and data management in the field of archaeology. It provides a broader perspective for analyzing landscapes, human settlements, natural resources, and topographical features that contain huge amounts of data that need to be linked in different ways. Most archaeologists are currently turning to geographic information systems to create large-scale databases to organize, analyze, and share the products of their field research and study general patterns. resulting from the increased use of technology in this field.

The importance of using geographic information systems on antiquities falls under the following points:

- Providing a window into past human behavior by looking at spatial relationships between people and natural features.
- Archaeologists analyze various relationships between social elements looking for evidence of social patterns.
- Providing archaeological evidence to support hypotheses and research. Improving archaeological methodology and enhancing archaeological research.
- Providing a more intuitive way to look at geographical relationships between archaeological sites.
- Providing a basis for understanding social behavior and the interaction between people and their environment. Providing a broader perspective of the archaeological context.

The use of GIS in archeology provides a bigger picture of the landscape and thus a deeper understanding of the way of life of those communities. Below are some of the main aspects that are analyzed using GIS in the field of archaeology:

- Human mobility analysis.

- Identifying sites and their relationship to natural features.
- Group interaction analysis.
- Study of social integration.
- Study of spatial organization.
- Political hierarchy.
- Study of settlement patterns.
- Study of the density of cultural material.
- Access to natural resources.
- Study of spatial distribution.

As for the applications of geographic information systems in the field of archaeology[36], archaeologists were among the first to use geographic information systems since the 1980s. The science of geographic information systems archeology has developed until researchers use it to uncover hidden parts of history and develop new insights into known settlements. The following is a statement of its applications in the field of archaeology:

1. Site Prediction Predictive modeling is a vital application of GIS in archaeology. By integrating historical map data, physical details of an area's landscape, and known information about past inhabitants, archaeologists can accurately predict the locations of sites of cultural, historical, or agricultural relevance.
2. Using LIDAR applications to identify unknown sites The passage of time affects even relatively recent heritage sites, but remote sensing technologies such as LIDAR help give a glimpse into the former way of life; This technology uses laser beams to scan large areas, and collects information as it passes over the area to be studied and analyzed, to produce data that helps operators visualize the landscape at the time and obtain a preview of the terrain, including obstacles and landmarks, without the need to actually enter the area.
3. Providing a new perception of ancient civilizations GIS reveals historical and cultural sites that have been overlooked, and also provides new context for known areas of research; Placing the information collected in a new context can give professionals new insight into a civilization's reasons for settling where they did or provide new potential explanations for their migration patterns.
4. Archaeological documentation: Archaeologists have realized the importance of using this modern scientific technology and employing it in the field of archaeological

recording to help preserve the identity and cultural heritage of each city, region, and site. Countries have begun to use it on a large scale to preserve various archaeological sites and to revitalize and promote tourism. This is because it allows for organizing complete databases that include all issues and information related to these sites. These rules are characterized by being constantly fed and updated with all social, natural, environmental and urban data related to the archaeological site.

The geographic information system was of great importance, especially during times of crises, such as the Covid-19 virus crisis, known as the emerging coronavirus. In addition to the role of this system in knowing the extent of the spread of the virus, it was an essential part of the work of virtual museums, which allow individuals to organize virtual trips to museums and archaeological sites in the world.

This system has capabilities that can be used to preserve historical areas. It works to monitor and document the existing urbanization of these areas in detail through satellite images, monitor their urban growth, and conduct a comparison over different time periods to determine the changes that have occurred in them, which in turn helps to identify the problems, challenges, and risks that these areas face, and which affect them directly or indirectly. Indirectly, and working to solve these problems and reduce them in a sound scientific manner according to the data and data entered. The system also helps provide support to officials and decision makers with warnings and recommendations resulting from realistic analyzes of problems, which contributes to making the most appropriate decision for the public benefit in documentation processes to preserve archaeological sites[35].

4. Ecology

As for ecology, it studies the relationship of living organisms with the natural environment in which they lived[37], and the archaeologist benefits from it in placing ancient man in the environment in which he lived, and knowing the extent to which he was affected by this environment and his influence on it, that is, his relationship with it, and this is a matter of great importance in the study of prehistoric times, and it is followed The study of the ancient environment is primarily the study of its animals and plants, especially the extinct ones. This leads to paleontology, which is the science of human and animal excavations, where the remains of an animal or plant are found preserved in rocks or buried under their decomposition over time periods[3]. Its techniques have developed and the study has

expanded. Fossil man and reached an estimate of his age on Earth in millions of years[38].

5. Topography

Topography is an accurate representation of the surface of the Earth with its natural and human elements. It is a Greek term composed of two words (topo), which means land or place, and graphie, which means drawing and graphical representation of the terrain. It is the science of signing and drawing natural and artificial bodies on a scale and drawn with internationally agreed upon conventional symbols on a piece of land. Paper or something similar is called a map, and the latter is a miniature geometric drawing of a part of the land that shows all the landmarks and features of strategic importance [39].

This science is concerned with studying the status, distribution and names of the population from a linguistic and historical perspective, laboratory studies of buildings of all styles and types, whether civil, religious or military, and studying all city plans and theirdevelopment. This science is also concerned with studying all population problems in theancient world.

The topographical study aims to exploit the potential of the surface appearance in all analyzes and conclusions related to it, or to one of the embodied and existing elements, whether human or vital, and in its status as a possibility or an obstacle. Below are some of the fields used for topography. Topography forms a cartographic basis for studying most planning and reclamation projects and the use of surfaces, i.e. Everything related to the useof surface maps, including civil engineering, public works, construction, and land use in various specializations[3].

6. Geophysics

Archaeological geophysics gives a picture of the invisible Earth using all kinds of physics, such as sound, light, electricity, and magnetism. This may indicate the presence of a dwelling, a basement, a tunnel, or something else. These sciences and their complex new technologies also help to date antiquities by various means, such as archaeological magnetism. Which helps in determining relatively close ages, such as determining the age of wood (Dendrochronology) for times less than (7420) years, or radiocarbon (carbon-14) for between (35-50 thousand years), or the amount of potassium-argon for about one million years, or Thermolominescence for periods ranging from thousands to millions of years, etc.. [3], [40].

7. Geology and Geomorphology

Geology[41] and geomorphology [42]are also considered auxiliary sciences in archaeology, as geology, as a result of its study of sedimentation, erosion, formation of rocks, their fragmentation, radiation, and the coal, minerals, or fossils in them, provides an idea about the age of these rocks and the atmosphere in which they arose. Based on a person's knowledge of these things, he can know their approximate or relative age. This initial knowledge provides the archaeologist with a basis from which to start further study. Geomorphology, which is one of the basic geological and geography sciences, has a direct bearing on archaeology, as it presents a picture of what occurred in a specific time in terms of formations in the surface of the earth, seas, and rivers in the region that is the subject of the archaeologist's research.

Geophysics[43] (earth physics) gives the archaeologist a picture of the invisible Earth using all kinds of physics, such as sound, light, electricity, and magnetism. This may indicate the presence of a dwelling, a basement, a tunnel, or something else. These sciences and their complex new techniques also help in dating antiquities by various means, such as archaeological magnetism. (Archomanetism) which helps in determining relatively close ages, such as determining the age of wood (dendrochronology) for times less than 7420 years, or radiocarbon (carbon-14) for between 35 - 50 thousand years, or the amount of potassium-argon for about one million years, or Thermoluminescence for times ranging from thousands to millions of years, etc. Ichonology is a geological science concerned with studying the effects of biology in sediments, and any archaeological collection in various geological formations.

8. Chronology

It is one of the historical sciences that is very useful to archaeology, and its subject focuses on the various calendars of countries and peoples, and since the third millennium BC, man has needed to record what concerns him in his economic, religious and political life, so calendars appeared in Egypt, Mesopotamia and Syria for the years of the rule of kings linked to the events that they experienced. Or it took place in their days, and the task of the specialist in calendar affairs is to study these calendars, compare them, and deduce the absolute date of a king or event[44]. This science is extremely difficult, and scholars have not agreed on a correct calendar for the events of the third and second millennium BC in Mesopotamia, for example. There are those who have a long, short, and medium calendar. A dispute arose between them over the reign of Hammurabi, for example, for more than a

hundred years[3].

It is important for the archaeologist to rely on calendar science to date the archaeological sites he discovers. There is no point in studying archaeological stratigraphic succession and studying rock layers (Lithostratigraphy), which is one of the branches of the study of Earth's layers in geology, without an orthographic background. The difficulty of calendar science is known from the correspondence between the Hijri and Gregorian calendars. So what would happen if the calendar of one family dates back three thousand years before that and was disjointed, contradictory, and ambiguous? This science follows the science of genealogy, and the Arabs have excelled so much in this science that they even traced the lineage of their horses with useful notarized documents[45], [46], [47].

9. Onomastics

The science of place names opens up good horizons for the archaeologist in research, by referring to the origin of the naming of places. This name clearly indicates the peoples who created these places[48], [49]. It has been said that cities speak the language of their founders. Then the place could indicate a defunct facility (well, bath, monastery, fort). The names of cities and locations do not change easily. In the Levant there are names of cities, some of which date back thousands of years (Damascus, Aleppo, Palmyra, Amrit, Arwad, and others)[3].

10. Photography

It specializes in transferring the existing archaeological nature as it is without distortion or alteration, whether this transfer is of architectural ruins or artistic masterpieces. This photogrammetry[50]has facilitated not only the task of archaeological description of both architecture and arts, because the deficiency in this description constitutes a serious scientific defect in it, but also It helped to preserve various archaeological features, especially inscriptions, writings, and decorations, so that they could be referred to when needed, and this was undoubtedly a great function that solar photography performed for archaeology, not only in the field of existing architectural monuments, artistic monuments, and artistic monuments preserved in museums and private collections, but also in the field of Excavation and archaeological study as well.

A. Aerial photography

Aerial photography helps in identifying the locations of antiquities, especially mud buildings, by determining the plans of these buildings according to certain signs that

appear in the soil, plants, and shadows. However, all of these signs appear meaningless or incomprehensible when the average person sees them while standing among them on his back. The ground is interconnected in the image taken from the air in a way that makes clear to the experienced excavator many of the archaeological phenomena of the site in which he wants to dig. This indicates, for example, that the presence of brick buildings or mud walls under some plants in an archaeological site increases the percentage of humidity in the ground under these. Plants, which helps them grow more than plants that do not exist underneath them, such as mud buildings or mud walls, and also helps them acquire a color that is different from the colors of other plants. Archaeologists became aware of this phenomenon, and began searching for these signs referred to, and often They were guided to some archaeological buildings under the plants, and thus it can be said that aerial photography was and still is helping not only to determine the architectural drawing of the buried archaeological buildings, but also to determine the general plans of the archaeological sites, and even the roads that connect them as well[3].

Colored and non-colored films are used for this type of photography, and special filters are also used for blue-ray or infrared photography, provided that the appropriate time is taken into account for photography at different angles, vertical and inclined, and so on.

B. Ultraviolet imaging

External antiquities often suffer from fine cracks in their surface skin, especially antiquities that are covered by a layer of liquid varnish to protect them, such as artistic paintings, Christian icons, etc. These cracks cannot be seen with the naked eye because they are very thin and transparent cracks, but if ultraviolet rays are reflected on them, Then it can be seen clearly, and here comes the importance of using these rays for imaging and treating the effect[3], [51], [52].

It is worth noting that in radiological imaging, whether infrared or ultraviolet imaging of the effect, it is necessary to protect the skin and eyes from exposure to these rays by covering them with clothing or using opaque barriers.

C. Xray Radiography

If photography only shows the visible (external) form of the photographed objects because it cannot show the characteristics and features inside this form, then the discovery of X-rays in 1895 solved this problem [53], because of the ability of these rays to penetrate into objects. It was then used in the field of archaeological exploration to determine what traces

the earth hides in its interior. It was also used to photograph some Pharaonic mummies from the 21st Dynasty (about 1100 BC), which is the mummy of Queen Najmat. This photography showed the presence of a heart scarab and four statues. A small picture of the children of the god Horus inside the chest cavity of this mummy, which indicates the extent to which these rays can help archaeology. We can say that X-rays were useful not only in the field of identifying antiquities in the ground, but also in the field of archaeological restoration in All over the world, and thus helped discover many phenomena that would not have been easy or possible without access to them[3].

D. Cosmic rays photography

It is scientifically known that the universe in which we live contains thousands of millions of small particles called mesons. The energy of these mesons reaches millions of electronic volts, and they fall on the surface of the Earth from outer space regularly. The matter of these rays remained unknown until Victor Hess discovered them (1912) and some scientists even called it in 1923 “cosmic rays”[3], [54], [55].

These rays remained far from the field of scientific application in archaeology until thought was given to a cosmic imaging project for the Egyptian pyramids in Giza. These rays were used for the first time to photograph the second pyramid, which was the pyramid of King Khafre. The aim of that was to try to identify what might have been in it. There are passages or chambers inside this pyramid that archaeology has not yet revealed. This is done by measuring the amount of cosmic rays that penetrate the stones of this pyramid, especially since the thickness of the stone through which these rays pass is less than in the blind parts in the case of passages or chambers. Hence, the amount of cosmic rays penetrating these rooms or corridors is greater than their amounts in other blind directions. This is a method that some agree is positive without harming the effect

The presence of hidden rooms in the pyramids of Giza and Mexico will remain an obsession for archaeologists around the world for many years to come, because they contain treasures of valuable information about the construction of those ancient civilizations, the way of life and the belief that was reflected in the antiquities. After archaeologists sent a robot through a narrow tunnel inside the Great Pyramid of Giza, hoping that it would shed some light on how these royal tombs were built about 4,500 years ago, they are today turning to using cosmic rays to uncover hidden rooms under the pyramids of Mexico[3].

Although the excavation process in the Great Pyramid of Giza did not result in a huge exciting discovery like the treasure of the young King Tutankhamun of the New Kingdom of Egypt, which was discovered by archaeologist Howard Carter (1922), Egyptologists hoped that the contents of the vault would help reveal the secret of the building. The two mysterious tunnels, which were discovered in 1872, are unique to two of the pyramids of Giza. But in Mexico, there is a strong belief in the existence of hidden rooms under the pyramids of the sun, and for this reason a team of scientists from the Institute of Anthropology at the National Autonomous University of Mexico began searching for hidden rooms and vaults under the pyramids of the sun in the archaeological area of Neotihucan[56][1].

Archaeologists explained that the site of the Pyramids of the Sun was the first large monument to be built in the region as a sacred mountain and the seat of Tlaloc, that is, the god of Teotihuacan[57], and that this Tlaloc was not only the god of rain, but he was also the god of the fertility of the earth. Researchers have developed a detector that uses advanced technology in the field of cosmic rays called muons to probe the depths of hidden rooms under the pyramids of the sun in Mexico.

The location of the Pyramids of the Sun was chosen because it contains a tunnel whose floor allows the placement of the device that will measure, throughout an entire year, the process of entering space radiation and the twisting paths it takes inside the building, which will determine the possibility of the existence of a room or a cavity inside it. The researchers took their location in the Axia Palace located to the north. From the Pyramids of the Sun, which may have been the great palace of the rulers of Teotihuacan.

The study could lead to two completely different situations. Either there is no inner room in the pyramid, or there are great possibilities for the existence of some rooms in which four leaders from sectors affiliated with Teotihuacan were buried, and so far only one room is known that was built by the people of Teotihuacan in some era. Before the Spanish invasion, despite the presence of other rooms completed by archaeologists in order to study the pyramids, the technology applied in this project is the installation of a muon

[1]Teotihuacan is an ancient archaeological city built in central Mexico in 200 BC. It is located about 40 kilometers northeast of Mexico City, the capital of Mexico. It is also called Teotihuacan. It flourished between approximately 200-750 AD. It has pyramids for the sun and moon, cemeteries, palaces, and many residences, and its area was (12 square kilometers) at the height of its prosperity.

detector[54],[55][1], which determines the angle of muon rays coming from space without harming the tunnel or the archaeological heritage. Once this is accomplished, Working, the detector would be used in any other pyramid in Mexico. The first time the space radiation device was used was by the physicist Louis Alvarez, who used it on the floor of the Pyramid of Khafre in Giza.

In the end, the research concludes thatAntiquities were a major reason for the emergence of art, as it is a product of human creativity[58], [59], and it is considered a form of human culture because it is an expression of "self-expression" and not an expression of a person's need for the requirements of his life, although some scholars consider art a life necessity for humans, like water and food[60], [61]. Art is considered a creative product of a person, in which he forms materials to express his thoughts, translate his feelings, or the images and shapes he sees and embody them in his works. There are physical arts such as painting, sculpture, decoration, pottery making, weaving, and cooking. The non-material arts are found in music, dance, drama, writing and telling stories[62], [63]. Art is considered a creative product of a person, in which he forms materials to express his thoughts, translate his feelings, or the images and shapes he sees and embody them in his works. There are visual arts such as painting, sculpture, architecture, interior design, photography, decorative arts, handicrafts, and other visual works[3].

Conclusions

- The results of archaeological studies related to evolutionary processes have become familiar to all anthropologists who study the phenomena of cultural change.
- Therefore, archaeologists - anthropologists - resort to benefiting from the research of geologists and climate scientists, to verify the (identity) of the remains they discover, and the history of their existence. Archaeologists also cooperate with specialists in natural anthropology, due to the large presence of human finds in excavations, along

[1]Muons: They are the substance of cosmic radiation. When atomic nuclei coming from outer space collide with the upper layers of the atmosphere, they produce residues of pions. The pions quickly decompose to give a spray of positive and negative muons that fall to the ground continuously. The goal of geological exploration was to follow muons as they moved through rocks beneath the Earth's surface.

with cultural remains. Modern archaeologists have succeeded in using radiocarbon dating as a means to accurately determine the age of remains.

- Archeology studies human history and the cultural changes that accompanied it, in an attempt to build a complete picture of the social life lived by ancient societies, prehistoric societies. Although archeology depends - to some extent on history - it differs from history in that it does not study Historical stages of civilization, but rather studies those periods that human society lived through before the invention of writing and the recording of history
- There is a complementary relationship between three sciences: archaeology, history, and sociology. Historiography and sociology are provided with or rely mainly on archeology to provide them with the required information.
- Historical geography added new things to historical and geographical research, as it attempts to reveal the types of urbanization, how it was distributed, the type of activity and the distribution of population therein.
- The use of the geographic information analysis tool (GIS) is useful in scientific research and data management in the field of archaeology. It provides a broader perspective for analyzing landscapes, human settlements, natural resources and topographic features that contain huge amounts of data that need to be linked in different ways.
- Most archaeologists today are turning to GIS to create large-scale databases to organize, analyze, and share the products of their field research and to study general patterns resulting from the increasing use of technology in the field.
- This system has capabilities that can be used to preserve historical areas. It works to monitor and document the existing urbanization of these areas in detail through satellite images, monitor their urban growth, and conduct a comparison over different time periods to determine the changes that have occurred in them, which in turn helps to identify the problems, challenges, and risks that these areas face, and which affect them directly or indirectly. Indirectly, and working to solve these problems and reduce them in a sound scientific manner according to the data and data entered.
- The system helps provide support to officials and decision makers with warnings and recommendations resulting from realistic analyzes of problems, which contributes to making the most appropriate decision for the public benefit in documentation processes to preserve archaeological sites.

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