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History of Science in Egypt (1)

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Abstract: *The emergence of science and its prosperity in any country requires sufficient maturity in moral and social ideals, and this requires a sufficient degree of centralization and political stability. This has been achieved early in the Nile Valley, its stability was long enabled Egyptians to consolidate and deepen the roots of their traditions and thereby facilitate the Egyptian civilization progress and development. Thus, the multiplicity of long periods of stability in Egyptian history was undoubtedly the most important factor in the progress of civilization and intellectual scientific creativity.*

The Egyptian civilization has excelled in different areas evidenced by archaeological evidence, arts and literature, alchemy, engineering, medicine, astronomy, sports. In addition to, their findings of the art of mummification.

Some archaeologists, indeed, claim to see in all other civilizations signs of an Egyptian origin. It is universally agreed, however, that in technical arts, Egyptian workers pointed the way to the rest of the world, and it is to them that all must turn for the first discovery of those facts that made science possible. In this series of articles we will try to shed light and focus on such history.

I. Introduction

As far as the Egyptian civilization excelled in different areas evidenced by archaeological evidence, which covered most of the land of Egypt and that abound in Egyptian museums and the world. It has excelled Egyptian civilization in architecture, arts and literature, science and faith, and left a clear imprint on some contemporary civilizations and the next and perhaps the most important evidence of creativity, the findings of the Egyptians in science, chemistry, medicine, astronomy, sports, and they were pioneers preceded others in the knowledge of writing a hieroglyphic, and of course engineering whose supremacy can still be seen today in the majestic architecture of the Pyramids and Karnack. Seven millennia ago, an ingenious technique for measuring time were invented to clock the periods of the Nile flooding, this methodology led to the birth of the solar calendar. Chemistry as a field has its root in the name of the ancient land and the art of the discipline was in full use there for the making of glass, bronze and metal chemistry.Even the synthesis of new compounds was apparently known at the time. According to a recent report by a team of French scientists, the eye cosmetics used at the time of Nefertiti contained a man-made lead compound that helped treat or prevent eye disease.[(1)]
Egypt has over the centuries been an important center for science and the history of science. As is well known, Alexandria during the Hellenistic period became the center of a multicultural scientific tradition that was the foundation for our modern science. During the Medieval Islamic period as well, a number of prominent scientists worked in Egypt. Egyptian scholars have also done a great deal to document and preserve that heritage. Eratosthenes, the geographer and 3rd c. B.C librarian of the Alexandria Library played a crucial role in cataloguing and conserving earlier scientific work. Also, the Library of Alexandria was a center of knowledge that gathered scholars from all over the world. In Alexandria some two thousand years ago, the library and museum constituted a center of gravity for scholars including Euclid, Archimedes, Hipparchus, and Hepatia.

II. SCIENCE IN OLD EGYPT

The Beginning: Rosetta stone Finding: When Napoleon, an emperor known for his enlightened view of education, art and culture, invaded Egypt in 1798; he took along a group of scholars and told them to seize all important cultural artifacts for France. Pierre Bouchard, one of Napoleon's soldiers, was aware of this order when he found the basalt stone, which was almost four feet long and two-and-a-half feet wide, at a fort near Rosetta. When the British defeated Napoleon in 1801, they took possession of the Rosetta stone. The irregularly shaped stone contained fragments of passages written in three different scripts: Greek, Egyptian hieroglyphics and Egyptian demotic. The ancient Greek on the Rosetta stone told archaeologists that it was inscribed by priests honoring the king of Egypt, Ptolemy V, in the second century B.C. More startlingly, the Greek passage announced that the three scripts were all of identical meaning. French Egyptologist Jean-Francois Champollion (1790-1832), who had taught himself ancient languages, ultimately cracked the code and deciphered the hieroglyphics using his knowledge of Greek as a guide. Hieroglyphics used pictures to represent objects, sounds and groups of sounds. Once the Rosetta stone inscriptions were translated, the language and culture of ancient

Egypt was suddenly open to scientists as never before. The Rosetta Stone has been housed at the British Museum in London since 1802, except for a brief period during World War I. At that time, museum officials moved it to a separate underground location, along with other irreplaceable items from the museum's collection, to protect it from the threat of bombs.

Chemistry in Old Egypt:

Chemistry is one of the natural sciences known to man and practiced a long time no one knows that has a beginning, and did not start like any other science in ancient civilizations independent. However, the principles of chemistry have known and been associated with the arts and many industries such as glass and its colored materials, metals melting, manufacturing of alloys, coatings, mummification, treatment, pharmaceutical, paper, textiles and other industries. We have known since the dawn of history, a number of chemical elements that are found free not combined with other chemical elements and is named after the seven stones, gold, silver, copper, lead, tin, iron and sulfur. The Egyptians knew some of the properties of these chemical elements, that gold is found in certain rocks exclusively a quartz or quartz particular species gray or black (Marion) or dyed red as a result of the metals they contain iron. The ancient Egyptians pry about these rocks in the deserts of Egypt and all the gold extracted them in large quantities, which made Egypt one of the richest countries of the ancient world. Some of the Pharaonic old gold mines retain its name until today such as mine Hoti, which is located near Mount Abu Dahr South Eastern Desert of Egypt, where there is a mixed Balmarw black gold. The ancient Egyptians neglected quartz veins transparent or white to brown free of gold. Which suggests that the ancient Egyptians had guided to that gold is accompanied by quartz veins colorful color dark because they contain metal impurities mostly it is what we know today we are on the basis of a chemical that gold would normally accompany some chemical elements colored rocks such as iron, titanium, vanadium, cobalt, chromium, nickel and others.

Egyptians knew since early times the natural glass, which consists as a result of impact collision of a large meteorites with sand on the surface of the earth whereas the sand fused due to the heat resulting from this collision and hardening of molten glass is made of sand. Depending on the color of this glass of mineral impurities associated with the sands, which are exposed to melting. At a later stage man-made sand in the glass melting furnaces private. And color by adding material to the metal melted sand before. The archaeologists found pieces of stained glass in the effects of the Pharaonic civilization in pre-dynastic period (before 3200 BC. M.). The Egyptians used natron (sodium salts) extracted from the Wadi Natrun Western Sahara in the glass industry as there are remnants of the effects of the glass factories in the Wadi Natrun. And making the Egyptians and Babylonians, Assyrians glass Kalozark many colors, purple, red, black, green and metallic materials by adding to the mixture before the melted glass. The Egyptians imported metals cobalt from Iran and Armenia to be used in the glass industry, where the cobalt blue colored glass favorite of the ancient Egyptians.

And mastered the Egyptians the art of mummification and excelled in it and made dyes for coloring clothes, crockery and draw pictures on the walls in the temples and tombs also excelled in the preparation and installation of drugs from medicinal herbs and he was doing this work specialists from priests in special places inside the temples and store the drugs in the vessels of pottery and glass. The people of ancient civilizations knew, leather tanning, and used alum and tannins and Nitrite and others for this purpose and the usefulness of alum and other salts in the process of tanning was to prevent rotting skin and corruption was done to treat the skin with dilute salts alum after the organization of the skin and result in a soft leather.

III. Metals and Minerals

Archaeologists divide the earliest history and prehistory of a country into periods represented by the different and progressive stages of culture that existed, and to these terms-Stone, Bronze, and Iron Ages are applied. Each of these stages is further divided into early, middle, and late periods to which suitable names are given. It is usually considered with regard to Egypt that the Stone Age terminated about 4000 B. C., but there is really no hope of our ever being able to fix a date, even roughly, for the earliest metal objects, because they are prehistoric.The Stone Age was followed by a period during which copper was used. Afterwards, on the introduction of tin, the Bronze Age proper began.

Period	Approximate time (Middle East)	
Neolithic Period (Late Stone Age)	8000 - 4000 BCE	
Chalcolithic Period (Copper Age)	4000 - 3150 BCE	Egypt: Beads from meteoric iron
Early Bronze Age	3150 - 2300 BCE	Egypt: Oldest bronze (Old Kingdom, from 2700 onwards)
Middle Bronze Age	2200 - 1550 BCE	First uses of iron in Hatti and Mesopotamia
Late Bronze Age	1550 - 1200 BCE	Egypt: Oldest iron blade,probably Hittite. No local iron

Early Iron Age	1200 - 1000 BCE	production
Iron Age II	1000 - 586 BCE	Egypt: Beginning of iron production

Archaeological period in Egypt Based on Metals classification
Abstracted from http://www.reshafim.org.il/ad/egypt/trades/metals.htm

Metallurgy in Egypt, in particular was carried on with an elaborate technique and a business organization not unworthy of the modern world, while the systematic exploitation of mines was an important industry employing many thousands of workers. Even as early as 3400 B.C., at the beginning of the historical period, the Egyptians had an intimate knowledge of copper ores and of processes of extracting the metal. During the fourth and subsequent dynasties (i.e. from about 2900 B.C. onwards), metals seem to have been entirely monopolies of the Court, the management of the mines and quarries being entrusted to the highest officials and sometimes even to the sons of the Pharaoh.

The principal metals employed in ancient Egypt were gold, copper, iron, lead, silver and tin, but one instance of the use of antimony and one of platinum are known. Three alloys were also employed, namely, bronze, which is essentially an alloy of copper and tin, electrum, an alloy of gold and silver, and, at a very late date, brass, which is an alloy of copper and zinc. In addition to these metals and alloys, a number of ores and natural mineral substances were also used.

Metals were entirely monopolies of the State, the management of mines and quarries being entrusted to the highest officials and sometimes even to the sons of the Pharaoh, metallurgical practice were of extreme importance to the State and were carefully guarded from the vulgar.

For example: Copper is found as Galena which was mined in Egypt at Gebel Rasas, a few miles from the Red Sea coast, Lead - though it never found extensive application, was among the earliest metals known, specimen having been found in graves of Pre-Dynastic Period. Iron-was known in Egypt from the early Dynastic Period but there is no neat progression to an Iron Age, Egyptians took a long time to begin using iron extensively. It was not used for decorative, religious or symbolical purposes, due to the fact that it rusts. Tin-was used in the manufacture of bronze.Cobalt has been detected as a coloring agent in certain specimens of glass and glaze. Neither metal occurs naturally in Egypt; norit seems probable that supplies of tin and cobalt ores were imported from Persia.

Story of earliest chemical manuscripts Leyden Papyrus [3, 4)]

In spite of Egypt is generally recognized as the mother of the chemical and alchemical arts, but unfortunately her monuments and literature have left little of the early records which explain these arts. Some of these ideas have been transmitted to us through Greek and Roman sources but the character of these sources do not enable us to discriminate between the matter derived from Egypt and the confused interpretation or additions of the early Greek alchemists. The stories told us that about 290 A.D. the Emperor Diocletian passed a decree compelling the destruction of the works upon alchemical arts and on gold and silver throughout the empire, so that it should not be the makers of gold and silver to amass riches which might enable them to organize revolts against the empire. This decree resulted in the disappearance of a mass of literature which doubtless would have furnished us with much of interest in the early history of chemical arts and ideas. However, fortunately there have been saved to our times two important Egyptian works on chemical processes; the earliest original sources on such subjects discovered at Thebes (South Egypt), and both formed part of a collection of Egyptian papyrus manuscripts written in Greek and collected in the early years of the nineteenth by Johann d'Anastasy, vice consul of Sweden at Alexandria. The main part of this collection was sold in 1828 by the collector to the Netherlands government and was deposited in the University of Leyden. In 1885, C. Leemans completed the publication of a critical edition of the texts with Latin translation of a number of these manuscripts, and among these was one of the two works above mentioned.

It is known as the Papyrus X of Leyden. The French chemist MarcelinBerthelot who was interested in the history of early chemistry, subjected this Papyrus to critical analysis and published a translation of his results into French with extensive notes and commentaries. On the basis of philological and paleography evidence, he concluded its date is about the end of the third century A. D. It is, however, manifestly a copy of a work previously written, as slight errors evidently due to a copyist, are found. That the original is later than the first century A. D. is certain, as there are included in it extracts from the *MateriaMedica* of Dioscorides. The work is a collection of chemical recipes and directions for: 1. making metallic alloys, Imitations of gold, silver or electrum, Dyeing and other related arts.

In 1913 at Upsala, Otto Lagercrantz published the Greek text with critical commentary and with translation into German of a similar Egyptian papyrus, the "Papyrus GraecusHolmiensis." This work like the Leyden manuscript is a collection of recipes for alloys, metal working, dyeing, imitations of precious stones and similar arts. Investigation developed that this manuscript also came from the Swedish vice consul at Alexandria, d'Anastasy, presented by him to the Swedish Academy of Antiquities of Stockholm. Here it slumbered

apparently unnoticed until 1906 when it was transferred to the Victoria Museum at Upsala. Examination and comparison with the Leyden Papyrus made it evident that the new papyrus was not only identical, but in all probability was in part at least written by the same hand. Both papyri were in remarkably well preserved condition. Both gave internal evidence of having been copied from other originals. Berthelot has suggested that the Papyrus X had been preserved in the mummy-case of an Egyptian chemist, and Lagercrantz agreed in the opinion and is convinced that the two works were the property of the same person, and that these copies were probably made as deluxe copies for the purpose of being entombed with their former owner in accordance with a common custom of placing in the tomb articles formerly owned or used by the deceased.The two manuscripts were taken together from an interesting collection of laboratory recipes of the kinds which Diocletian ordered destroyed and which apparently were very generally destroyed. The date ascribed to them is about the time of the decree of Diocletian, and it may be presumed that, in the mummy case, they escaped the execution of that decree.

The laboratory manuals, from which these copies were made, were written not for public information but for the guidance of the workers. The recipes themselves are often very detailed directions, but often also were mere hints or suggestions, sometimes elliptical to such an extent as to give no clear idea of the process as carried out. The Leyden papyrus comprises about seventy-five recipes pertaining to the making of alloys, for soldering metals, for coloring the surfaces of metals, for testing the quality of or purity of metals, or for imitating the precious metals. There are fifteen recipes for writing in gold or silver or in imitation of gold and silver writing. There are eleven recipes for dyeing stuffs in purple or other colors. The last eleven paragraphs are extracts from the *MateriaMedica* of Dioscorides, relating to the minerals or materials used in the processes involved. Berthelot notes that the artisan who used these notes while a practical worker in metals, especially the metals used by the jewelers, seemed to be a stranger to the arts of enamels and of artificial gems. It is, therefore, of great interest to discover that the Stockholm papyrus supplements the Leyden recipes in this direction. The Stockholm manuscript contains in all about a hundred and fifty recipes. Of these, only nine deals with metals and alloys, while over sixty relate to dyeing and about seventy to the production of artificial gems. Some ten others deal with the whitening of off-color pearls or the making of artificial pearls. It has been noticed that there is practically only a duplication of recipes contained in each of the manuscripts, and very similar recipes occur in both. The recipes in both are empirical with no evidences of any occult theories, nor any of that obscurity of language which is so characteristic of the later alchemists. The parts dealing with the metals are largely concerned with transmutation of gold, silver or electrum from cheaper materials, or with giving an external or superficial color of gold or silver to cheaper metal. There seems to be no self-deception in those matters. On the contrary, there are often claims that the product will answer the usual tests for genuine products, or that they will deceive even the artisans. The vocabulary of materials used is practically that of Dioscorides, with few changes in the meaning of such terms as are used by him, although at times the Latin equivalents of Vitruvius and Pliny have been employed. There is little to be found in these manuscripts which suggests that there has been any advance in the practical arts as known in the times of Dioscorides and Pliny and which had been less specifically described by them, but the papyri in the more definite and detailed directions they give, throw a very interesting light upon the somewhat limited fields of industrial chemistry, of which they treat.

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