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THE QUESTION OF THE USE OF BITUMEN OR PITCH BY THE ANCIENT EGYPTIANS IN MUMMIFICATION

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BITUMEN may be either (a) a mixture of hydrocarbons originating in petroleum found naturally impregnating certain porous rocks, generally limestone, but occasionally sandstone, in various parts of the world, as for example at Seyssel in France, Val de Travers in Switzerland, Ragusa in Sicily, as well as in Italy, Germany, Syria, America, etc., or (b) a similar material mixed with varying proportions of mineral matter found in the form of deposits, as in the well-known "pitch" lake in Trinidad, and in the Bermudez "pitch" lake in Venezuela. Bitumen in this latter form is frequently called "soft pitch."

Pitch may be either natural or artificial. Natural pitch is simply bitumen which has become solid by exposure, and is found in Trinidad and Venezuela accompanying the softer variety, as also in the neighbourhood of the Dead Sea. Artificial pitch, which resembles the natural article very closely in appearance, is obtained by the destructive distillation of coal, wood, etc.

From a study of the writings of the Egyptian, Arab, Greek and Latin authors, who treat of the subject of mummies and mummification, there would seem to be no doubt whatever that either bitumen or pitch, or both, were extensively employed by the ancient Egyptian in the preservation of the dead.

The study of modern writers on the subject of mummification would also seem to lead to the same conclusion.

I have ventured to suggest, however, on two previous occasions, that possibly the general idea that bitumen or pitch was frequently used may be erroneous¹.

I will now summarize briefly the arguments on both sides of the question.

The Rhind papyrus written by an Egyptian of Ptolemaic times in describing the methods employed in mummification mentions various ingredients used, among which was pitch, and this is stated to have been put into the skull².

The Arab physician Ibn Betar writes "The name *mumia* is given to the drug of which mention has just been made (i.e. by Dioscorides who is quoted for the statement that *mumia* flows down from the lightning mountains and becomes hard and thick and has a smell like pitch) and to that which is called Bitumen of Judaea, and

¹ (a) Annual Report 1907-8 *Arch. Survey of Nubia*, Vol. II, Cairo, 1910. (b) *Preservative Materials used by the Ancient Egyptians in Embalming*, Cairo, 1911.

² A. Henry Rhind's *Zwei Bilingue Papyri*, trans. BRUGSCH, Leipzig, 1865, pl. v, p. 4.

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to the *mumia* of the tombs...which is nothing else than a mixture which the Byzantine Greeks used formerly for embalming their dead...¹."

'Abd-el-Latif states that "mumia or bitumen" taken out of the skulls and stomachs of mummies varied "very little from mineral pitch²."

Diodorus, who describes the Egyptian mode of embalming, omits any mention of bitumen or pitch from the list of materials he enumerates as being used, but in his description of the Dead Sea, this writer, referring to the bitumen found in the neighbourhood, states "This source of wealth the Barbarians possess, and they take it into Egypt, and there sell it for embalming the dead, for unless bitumen is mixed with the other spices the bodies will not remain long undecayed³."

Strabo, in his account of the various places from which bitumen was obtained, among which he includes the Dead Sea, writes "The Egyptians use the asphalt for embalming the dead⁴."

Herodotus, however, although he refers to bitumen on several occasions, and describes in detail the method and materials used by the ancient Egyptians in embalming, makes no mention whatever of bitumen or pitch being employed for that purpose.

Pliny also frequently refers to bitumen, but says nothing about its use in mummification.

Josephus and Tacitus both describe the Dead Sea and the occurrence of bitumen, but make no mention of its use in embalming.

As already mentioned, most modern writers definitely state that bitumen or pitch was used, and even the very name mummy is said to be derived from a word meaning bitumen⁵.

Pettigrew states that he found bituminous matter in the head of a mummy, and quotes Rouelle, Granville, Greaves and Verneuil as also finding bituminous matter in mummies⁶.

Rouyer mentions bitumen as being used in embalming⁷.

Lortet and Gaillard state that bitumen "joue toujours le plus grand rôle dans la momification de l'homme et des autres vertébrés," and particular mention is made of it having been found by them on the mummies of dogs, cats, bulls, antelopes, sheep, goats, monkeys, birds and reptiles, and in fact in at least some instances on all the different kinds of mummies they examined except fish, on which it was never found⁸.

Daressy, describing various mummies he has examined, mentions bitumen as being found in several instances⁹.

¹ Quoted by BUDGE in *The Mummy*, Camb. 1894, p. 174.

² Quoted by BUDGE in *The Mummy*, Camb. 1894, p. 174.

³ Diodorus Siculus, *Bibliotheca Hist.* ed. P. Wesseling, Amster. 1746, xix, 98.

⁴ Strabo, *Geogr.* ed. A. Meincke, Leipzig, 1853, xvi, ii, 45.

⁵ (a) BUDGE, *The Mummy*, Camb. 1894, p. 173. (b) BUDGE, *A Guide to the Egyptian Collections in the British Museum*, London, 1909, p. 158. (c) Article "Mummy," *Ency. Brit.* 11th ed. Vol. xviii, Camb. 1911.

⁶ T. J. PETTIGREW, *Hist. of Mummification*, London, 1834.

⁷ P. C. ROUYER, "Notice sur les Embaumements des Anciens Egyptiens," *Description de l'Egypte, Antiquités*, Tome i.

⁸ LORTET and GAILLARD, *La Faune Momifiée de l'ancienne Egypte*, Lyon, Vol. i, 1905, Vol. ii, 1909.

⁹ G. DARESSY, (a) "Note sur la Momie de Thoutmosis IV," (b) "Ouverture des Momies provenant

Maspero writing of mummies in general says that "A mask of pitch was placed over the visage to preserve it," and with reference to Thûtmosis III and Ramses II respectively he writes "...the face which had been plastered over with pitch at the time of embalming..." and "The skin shows an ochreous yellow colour under the black bituminous plaster¹."

Elliot Smith writes, (a) "In the later (Roman) period the extensive use of bitumen as a preservative led to the rapid deterioration of the art," (b) "One of the seven crania...has been treated by the crude bitumen process which is distinctive of the Græco-Roman period. The cranial cavity is filled with pitch and the surface of the head is coated with layers of cloth soaked in bitumen," (c) "In the mummies of the Græco-Roman period the cranium is often filled with pitch²."

Wood Jones, describing the mummies found during the Archaeological Survey of Nubia, writes (a) "The bodies are well preserved in bitumen and wrappings³," (b) "Molten pitch was passed into the vertex of the skull⁴," and (c) "It is certain that the pitch was melted and freely liquid when it came into contact with the mummy⁴."

Reisner states also with reference to some Nubian mummies that (a) "The bodies were mummified...that is, prepared with bitumen," and (b) "The rock-cut tombs were simply packed with mummies, some of them prepared with resin and wax, and some with bitumen⁵."

In view of the array of evidence in favour of the extensive use of bitumen or pitch by the ancient Egyptians, it seems very presumptuous to suggest that much at any rate of the material described as bitumen or pitch was probably something else, and that the eminent authorities who identified it were mistaken, but such I believe to be the case, and I will now give the reasons for my opinion.

In the first place, I cannot find it stated that any careful or systematic examination or analysis of the material has ever been made, and apparently nothing of the sort has been done, the recognition being based solely upon the appearance of the material, with, in some few cases, its behaviour on burning. But any such superficial examination is not only useless, but misleading, and nothing short of a chemical analysis is sufficient to establish the identity of these materials.

A large proportion of what is frequently called bitumen or pitch, I believe to be resin, gum resin, or gum, blackened like so many other organic materials by the changes brought about by age and exposure. In some cases, however, the black material is wood pitch, and so far I have not been able to find a single example of bitumen or mineral pitch.

But since resins and gums all contain oxygen in considerable amount, while few bitumens or mineral pitches contain oxygen at all, or only to a very limited extent, it would seem an easy matter to settle the question by ultimate analysis once for all

de la Seconde Trouvaille de Deir el Bahari," *Annales du Service des Antiquités de l'Égypte*, Tome iv, Le Caire, 1903.

¹ G. MASPERO, *The Struggle of the Nations*, Eng. Trans. London, 1896, pp. 289, 429, 509.

² Prof. ELLIOT SMITH, F.R.S., "A Contribution to the Study of Mummification in Egypt," *Mém. de l'Inst. Égypt.* Tome v, Le Caire, 1906.

³ Dr WOOD JONES, *The Archaeological Survey of Nubia*, Bull. 1, Cairo, 1908, p. 38.

⁴ *Ibid.* Report 1907-8, pp. 205, 212.

⁵ Dr G. REISNER, *The Archaeological Survey of Nubia*, Bull. 2, Cairo, 1908, pp. 9, 17.

in a manner that could admit of no doubt. Unfortunately, however, I have been unable to avail myself of this direct method up to the present, partly because the time at my disposal has been very limited, partly because the amount of available material has been too small, and partly because I have felt that the results were likely to be useless for purposes of identification, owing to the fact that much of the material was contaminated with fatty matter and other substances derived from the body, and also because the method is liable to considerable experimental error due to a tendency of the products of combustion to form acetylene and other unsaturated hydrocarbons, instead of carbon dioxide and water, and so to increase apparently the amount of oxygen present which is always calculated "by difference."

Failing a direct method of analysis recourse has been had to indirect methods, which will now be described.

In the following table are given the mean results of the analyses of authenticated specimens of bitumen, mineral pitch, and wood pitch, and of various samples of black preservative material resembling pitch¹.

No. of Samples examined	Nature of Sample	Solubility in			Sulphur
		Petroleum Ether	Alcohol (hot)	Water (hot) after alcohol	
1	Genuine bitumen of Judaea ...	% 44·6	% 9·7	% 0·7	% ...
4	Genuine mineral pitch from Judaea and Dead Sea	42·3	10·8	0·2	8·7
2	Genuine wood pitch	62·3	89·1	trace	...
10	Pitch-like material believed to be resin	4·5 ²	65·6	3·4	1·4
4	Pitch-like material believed to be gum	0·7 ²	4·7 ³	44·8	...
5	Pitch-like material believed to be wood pitch	46·0	77·8	1·0	1·2

In order to be able to interpret the analytical results of the black pitch-like materials it is necessary to know first what are the respective characteristics of resin, gum, bitumen, mineral pitch and wood pitch.

The following points, I think, will be conceded by all chemists, namely:—

- (1) That resins are freely soluble in alcohol, and either are not soluble in water at all or only soluble in water to a very limited extent.
- (2) That gums are freely soluble in water, and either are not soluble in alcohol at all or only soluble in alcohol to a very limited extent.

¹ A large number of other samples of preservative material have also been examined, but as these were not black, the results are not included: some proved to be resin, some gum resin, and some gum.

² Largely fatty matter.

³ Partly fatty acids.

From the analyses of the samples of genuine bitumen, mineral pitch and wood pitch, the following points may also be accepted, namely:—

- (3) That the marked characteristics of bitumen and mineral pitch are (*a*) low solubility in alcohol, (*b*) high sulphur content, and (*c*) comparatively high solubility in petroleum ether.
- (4) That the marked characteristics of wood pitch are (*a*) high solubility in alcohol, (*b*) comparatively high solubility in petroleum ether.

On reference to the analyses of the preservative materials given in the table, it will be seen that the samples may be divided into three classes; first, those with a high solubility in alcohol, accompanied by a low solubility in petroleum ether and a low sulphur content; secondly, those with a high solubility in water accompanied by a low solubility in alcohol and in petroleum ether; and thirdly, those with a high solubility in alcohol accompanied by a high solubility in petroleum ether and a low sulphur content.

The first class I believe to be resin, the second gum, and the third wood pitch.

In addition to the analytical results recorded in the table there are many other proofs that the samples in question are not bitumen or mineral pitch, such, for example, as the facts that none of the samples gave the marked fluorescent appearance with the various solvents which is so striking a feature of bitumen and mineral pitch, and that the alcohol and petroleum ether extracts were brown and resinous looking.

It may be noted that a characteristic feature of wood pitch is that it is generally found to soften during the summer.

It is believed that the various specimens of resin and gum which are now black were not so originally, and some proof of this is shown by the fact that portions of one sample which is black and pitch-like are brown, while one corner is almost ruby red, and that other samples are in part brown.

That bitumen or mineral pitch may have been used in Ptolemaic or other times as a mummy preservative material is in no way denied, all I wish to show is that it is unsafe to apply this description to any preservative material that happens to be black and pitch-like, and that in the past many mistakes in identification have undoubtedly been made.