

Effective Mummification Compounds Used in Pharaonic Egypt:

Reactivity on Bone Alkaline Phosphatase

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In Pharaonic Egypt from the Old Kingdom up to the Ptolemaic Period the deceased were pre-treated in the course of the mummification process using a wealth of embalming components including resins and many different wood tars. GC/MS studies allowed the elucidation of a great number of clearly separated compounds found in the ancient embalming material. Phenols, guaiacols, naphthalenes, monoterpenes, sesquiterpenoids, oxidised diterpene resin acids and triterpenoids were noticed. These results and particularly the detection of an unused embalming material shed some new light on the possible way as to how the different embalming materials might have been prepared and applied. It was striking to see the accordance of the present data with the well-known treatises by Herodotus (490–425 B. C.) and by Pliny the Elder (23/24–79 A. C.). The impact of the historical observations on modern science and in return the dramatic promotion of ancient texts stimulated by the present study is intriguing.

An enzyme, alkaline phosphatase, bound inside mummified bones was a useful tool to reveal the efficacy of the embalming materials. Initial data showed that alkaline phosphatase isolated from embalmed bones from the Old Kingdom and the Ptolemaic Period was significantly more abundant and displayed a higher activity compared to the properties of the corresponding enzyme from non-treated mummified bones.

Additionally, in a model study porcine ribs were pre-treated with four selected embalming compounds – guaiacol, limonene, α -pinene and *p*-cymene – and subsequently air-dried. Among the four selected compounds guaiacol was the most reactive species in the course of the preservation process. The specific activity of bone alkaline phosphatase rose 12-fold compared to that of the control. The enzyme itself remained unharmed as the observed relative molecular mass was surprisingly identical with the contemporary enzyme. It was again striking that the guaiacol derivatives were richly abundant in the unused embalming material mentioned above.

Key words: Alkaline Phosphatase, Cedrium, Guaiacol, Mummified Enzyme, Pliny the Elder