



Mini-review

MODERN DAY PLASTINATION TECHNIQUES – SUCCESSOR OF ANCIENT EMBALMMENT METHODS

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ABSTRACT

The purpose of this study is to find, analyse and systematise the basic ways of embalment and their application in contemporary methods of plastination. In most of the ancient mummies the internal organs and the brain were removed. Usually the best-preserved samples were under additional protective circumstances - low temperatures, dry air, draught, or isolating cover of the body. Chinchoros used NaCl and, later on, fire for drying of body cavities. The dehydration factors in the Pacific mummies were warmness and smoke, while ancient Egyptians used sodium salts. Chinchoros covered the whole body with manganese dust, brilliant ochre or clay. The skin of the mummies from Melanesia was coated with fats mixed with red ochre, and Egyptians impregnated the dead bodies and linen bandages with herbal oils derived from Cedar Tree (*Cedrus atlantica*). The ancient principles of embalment – dehydration and impregnation are used also in modern plastination technologies, including plastination with products of type "Biodur Sn".

Key words: Anatomy, Biodur, mummies, organs, corpse

INTRODUCTION

For many centuries scientists have tried to create effective and health-safe method of conservation and long-lasting preservation of corpses. Mummies and anatomic preparations created in the past have had many disadvantages, which is the reason for continuous research today

GOAL AND TASKS

The goal of this study is to find, analyse and systematise the various basic ways of embalment and their application in contemporary methods of plastination.

BASIC INFORMATION

According to Gwinn et al. (1) embalment is a complex process of treating dead bodies with balsams to protect them against actions of putrefying bacteria and tissue enzymes,

thereby creating mummies.

According to SBE (2) the embalment is "...artificial conservation of corpse to prevent it from rotting. Balsams, resins, ether oils, spirit, formalin, carbolic, glycerin and sublimate are used."

Mummification (3) can be a result of natural causes (spontaneous, natural mummification) or result of deliberate human activity (artificial mummification, embalment)

Spontaneous mummification often happens in one of the following cases:

- When human bodies fall into peat bogs or alpine, or Arctic glacier.
- After quick, deliberate or accidental drying of the dead body in hot or cold, but dry deserts.

Tens of **bog mummies** have been found during XIX and XX centuries in Northwestern Europe (**Table 1**). Though some of them are older than 2,000 years, yet most are in excellent physical conditions (4).

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Table 1. The most famous “bog mummies” in Europe					
Name (nickname)	When was found?	Where was found?	Age	Condition	Where is kept?
The man from Lindow	1984	Great Britain	50 B.C.	Excellent	British Museum
The man from Rendswuhren	1871	Germany	-	Excellent	Landesmuseum-Schleswig
The girl from Yde	1897.	Holland	100 B.C.	Very good	Drents Museum- Assen
The man from Tollund	1950	Denmark	50 B.C.	Very good	-
The man from Grauballe	1952.	Denmark	B.C.	Very good	Moesgerd Museum-Aarhus
The girl from Windeby	1952	Germany	50 B.C.	Good	Landesmuseum-Schleswig
The man from Husbake	1936	Germany	Roman age	Good	Landesmuseum-Oldenburg
The man from New England	1941	Germany	Roman age	Good	Landesmuseum-Oldenburg
The man from Neu Versen	1900	Germany	-	Not good	Landesmuseum-Hanover
The men from Weerdinge	1904	Holland	Roman age	Bad	Drents Museum - Assen
The girl from Borremose	-	Denmark	-	Not good	-
The man from Bockhornefeld	1934	Germany	-	Not good	Landesmuseum-Oldenburg
The man from Damnedorf	-	Germany	300 B.C.	Bad	Landesmuseum-Schleswig
The man from Emmer-Erfischeidenveen	1938	Holland	1200 B.C.	Bad	Drents Museum- Assen

Ice mummies are few but, due to good preservation in low temperatures, are a source of scientific findings about ancient people. The best-preserved ice mummies found at different altitudes are:

- Otzi – the ice man from the Alps (Hauslabjoch) – 3200 m (5);
- The prince from peak Plomo (Chile) – 6090 m (6);
- The baby from the Andes (Argentina) – 3600 m (7);
- Juanita – the girl from mountain Ampato (Peru) – 6094 m (8);
- The children from mountain Liullaillaco (Argentina) – 6700 m (7);
- The mummies from the “Greenland group” (Qilakitsoq) (9);
- Kwaday Dan Sinchi – the hunter from Canada – 1982 m (10).

Sandy mummies are created after quick, deliberate or accidental drying of the dead body in areas with climate suitable for mummification and many years preservation (Table 2).

The best-preserved mummies are from the desert Tacla Macan in western China (11). Popular mummies from this desert are ‘The man and the woman from Cherchen’; ‘The women with the child from Cherchen’; ‘The Beauty from Loulan’. They are kept in the provincial museum of Urumchi – the capital of Uigurian autonomous region (Xinjiang Uigur).

The oldest well-preserved sand (desert) mummy is found in South America and it is 9,000 years old.

Today it is accepted that the first embalment techniques have been applied in South America (12). Mummies created by the tribes **Chinchoros** and **Chachapoyas** are well studied. Their embalmers would remove the internal organs and after burning out the body cavities would replace them with artificial materials. Chinchoros would return the skin to the skinned body, which in the meantime was kept in salted water and covered it in manganese dust (black style), and after 2,500 BC in brilliant ochre (red style). Most of the

bodies found – 149, are kept in Museo Arqueologico San Miquel de Azapa. The best-

preserved 'black style' mummy is the 'Child from the valley Camarones' from 5,050 BC.

Location	Age	Condition	Factors	Where they kept
The Atacama Desert	500-8000 years	Good	Dry, and clean air; permanent winds; alkaline reactions of the soil	Museo Arqueologico de San Pedro de Atacama
The Sahara Desert	5 000 years	Good	Dry hot air; strong sun radiation	British Museum, Manchester Uni. Museum
The Tacla Macan Desert and a basin of the river Tarim in West China, around the towns of Cherchen and Loulan	4 000 years	Excellent	Primary low temperature; salty sandy soil; dry air with permanent streaming; high summer mummifying temperature	Provincial Museum of Urumchi, West China, Uigur autonomous region

N	Age	Sex	Year	Source	Collector	Curation
<i>Mummies from Torres Strait</i>						
1.	Adult	m	1898	Stephan Island	W.P. Pettard	Queensland Museum
2.	Adult	f	1898	Darnley Island	A.H. Palmer	Queensland Museum
3.	Child	m	1900	Darnley Island	-	R.C.S. Museum
4.	Adult	m	1875	Darnley Island	Wm. Maclay	Maclay Museum
5.	Adult	m	1872	Darnley Island	C. Lemaistre	R.C.S. Museum
6.	Child	-	1849	Darnley Island	O. Stanley	Merseyside Co. Museum
7.	Child	m	1880	Stephan Island	J. Chalmers	Voelkerkunde Museum
8.	Child	f	1880	Stephan Island	J. Chalmers	British Museum
9.	Adult	m	1884	-	J. Douglas	British Museum
<i>Mummies from Australia</i>						
1.	Adult	m	1905	Cape York	H. Klaatsch	Berlin Society
2.	Adult	m	1845	Adelaide	G. Grey	R.C.S. Museum
3.	Adult	f	1936	Cape Jervis	N.B. Tindale	National Museum - Australia
4.	Infant	-	1927	Murray River	H.J. Sheard	National Museum - Australia
5.	Adult	-	1927	Cape York	U. McConnel	Cremated

The embalment process for **Egyptian mummies** lasted 70 days and had two main stages: a) mechanical and chemical processing of the corpse; b) dressing the dead.

During the first stage embalmers would take out the brain and all internal organs and after 40 days drying with NaCO₃ they would put them into special containers under the protection of "the four sons of god Hor". After the 40th day they would fill the dried body cavities of the mummies with linen cloth

soaked with aromatic resins and the skin is treated with oils and impregnated with wax. After additional 15 days they would begin wrapping the body in linen bandages soaked in conservative solutions (13, 14).

Pacific mummies (3) were created by the ancestors of today's aborigines in Melanesia, Papua New Guinea, Australia and the islands of Torres Strait. (**Table 3**)

After smoking the body for 3 days with the help of a fire underneath, embalmers would

remove the skin bubbles and take out internal organs to replace them with resin of local kind of palm tree. Brain was removed through an occipital cut and the skin is covered with red ochre mixed with coconut oil or body's own fats.

Most of those mummies are kept in Macley Museum or other museums in Australia, as well as American collections.

Plastination. Plastination is a modern revolutionary scientific method for lasting conservation of organic matter, created by the German anatomist Gunther von Hagens (15). He uses new products of the chemical industry to incorporate health-safe way of conservation and long-lasting preservation of tissues. During plastination process tissue liquid and part of the tissue fats are replaced with polymerising resins.

DISCUSSION AND CONCLUSIONS

In more of ancient mummies the internal organs, the brain and the fats have been removed. Usually the best-preserved samples were under additional protective circumstances - low temperatures, dry air, draught, or isolating cover of the body.

Dehydration has an important role in embalment techniques. Chinchoros used NaCl, and later fire for drying of body cavities. The dehydration factors in the Pacific mummies are warmth and smoke, while ancient Egyptians used sodium salts.

Impregnation is soaking the soft tissues with chemical compound with preserving characteristics. Chinchoros covered the whole body with manganese dust, brilliant ochre or clay. The skin of the mummies from Melanesia have been coated with fats, mixed with red ochre, and Egyptians impregnated the dead bodies and linen bandages with herbal oils and resins whose composition is not yet established.

The answer to this question is given by Koller et al. (16) who uses gas chromatography to prove that embalment products in ancient Egypt are derived from Cedar Tree (*Cedrus Atlantica*)

Fixation often has been combined and made equal to impregnation. In ancient times they used salt water, live coals, palm wine or tannin barks from trees, and peat.

The ancient principles of embalment are used also in modern plastination technologies, including plastination with products of type "Biodur Sn" used originally in anatomical practice by Gunther von Hagens in 1979.

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