

## **Treatments for burns in the *London Medical Papyrus* show the first seven biblical plagues of Egypt are coherent with Santorini's volcanic fallout**

### **Abstract**

Six treatments for burns in the *London Medical Papyrus* provide data regarding a volcanic fall out over Egypt. They confirm a previously established scenario linking the medical text to one specific eruption, the one at Santorini in the Bronze Age. One treatment describes the contamination of waters with the ash. Four treatments describe the effects of the ash on the skin. The sixth treatment describes the effect of acid rain following the dispersion of ash in the atmosphere, which triggered weather anomalies. The scenario derived from the medical document, is based on ash from Santorini that sedimented at the bottom of Egyptian lakes, and fits the description of Egypt in the papyrus *The Admonitions of an Egyptian Sage*. Finally, the scenario explains the nature of first seven biblical plagues of Egypt in light of the aftermath of volcanic ash littering Egypt.

### **Background**

A prescription in the *London Medical Papyrus* [1] was found to explain the early disasters of the so-called biblical plagues of Egypt. Briefly, *London Medical Papyrus 55* (L55) describes an unusual treatment for burns from red water. The treatment oddly excludes rinsing of the burn, and only prescribes the application of an alkaline mixture, implying the wound from red waters had been caused by acids, and that the Nile, the most readily accessible source of water could not be used. As syllogisms go, the Nile was

the source of the red acidic waters. A red, undrinkable, deadly Nile is exactly what is presented as the first biblical plague of Egypt (Ex.7.20-24) [2]. The simplest natural way for the Nile to have been contaminated would have been through a heavy fall out of volcanic ash [3].

This acid-based explanation fits the three subsequent plagues, more so than any other explanation proposed to this day [4-10]. Briefly, the frogs of the second plague (Ex.7.26-8.11) [2] would have kept their dual lifestyle until the river reached an acidity which they could no longer tolerate, confining them to the banks where they would die desiccated. The rotting meat of fish floating on the waters, the dead frogs, and the wounds of the living, would have attracted invertebrates laying eggs in the readily available flesh. The larvae thereof would have formed the third plague of *kînnîm* vermin (Ex.8.12-15), which furthermore finds a parallel in *L55*, since the wounds of the red waters became infected with vermin. Finally, the adult insect form, the biblical 'arob (mixed species of insects) of the fourth plague would have followed (Ex.8.16-20) [2] [3].

### **Treatments for burns in the *London Medical Papyrus***

Four additional treatments in the *London Medical Papyrus* confirm the scenario that emerged from *L55*. Both *L47* and *L48* treat unusual burns, and state that the god Horus, who symbolized the royal power in Egypt, had been burned in the desert, and could not access water to relieve his burns. His mother, the goddess Isis, stated that she would go and help her son, and prescriptions are uttered. *L47* applies a mix of gum, feline fur and milk from a woman. *L48* applies a mix of plants and other items, which have

unfortunately been lost in the document that did not survive unscathed through the centuries.

The burns in the desert of *L47* and *L48* do not appear to be trivial sun burns, which constitute the most common burns in the desert. The mention of gods would imply (in the eyes of the ancient Egyptians) serious matters. Yet which kind of burns would a person incur in the desert beside those derived from the sun?

The volcanic fall out provides an answer: *L47* and *L48* would describe the effects of volcanic ash in the desert near the Nile banks where people would not have witnessed a red Nile. However, those exposed outdoor would have experienced unusual burns on the skin, and looked for water, which is the standard first treatment for burns. However, as mentioned in *L47* and *L48*, water was not available. Physicians who examined the patients appear to have applied alkali-based mixes (breast milk, and possibly the plant extract) with success, confirming the acidic nature of the caustic agent.

The *London Medical Papyrus* lists two additional treatments that are compatible with a volcanic aerosol. *L52* and *L56* describe how to treat small white spots derived from burns, and require honey and a plant called *djaret*. *L52* also asks for a mineral called *keshu*, while *L56* calls for a material that could be yellowish amber.

Raw honey is slightly alkaline, and as already noticed with *L55*, many plant extracts tend to be alkaline [3]. Although it is not clear what the two minerals are, for the sake of consistency in the prescription with the other ingredients, the minerals would have either been alkaline or an inert excipient. It is therefore safe to assume that the burn being treated had been caused by acids.

The presence of small spots over the body indicates the caustic agent was finely dispersed. Yet this is the Bronze Age, and thus, in the absence of man-made technologies enabling spraying, the aerosol had a natural origin. A fall out of particles such as volcanic ash would provide such a burn pattern, and be well suited for an alkali-based treatment.

### **The time Santorini erupted**

*L55* was linked to the biblical plagues thanks to the red water [3]. However, *L47-L48* as well as *L52* and *L56* do not provide similar details, and the real link for these four treatments is the identity of the volcanic eruption for which the treatments were developed.

Egypt has no active volcanoes, and ash must come from hundred of kilometers away, which makes volcanic fallouts a rare events in the country. Sediments from the bottom of Northern Egyptian lakes match material at the Santorini volcano in the Aegean, and show that one large volcanic fall out took place in the Bronze Age. The generally accepted date for the event is around 1627 BC [11], while the ash retrieved in the Nile Delta indicates a 1609-1526 BC [12] date, and the confluence of archaeological, historical, scientific and biblical data indicate a 1602-1600 BC time point [13].

The *London Medical Papyrus* was finalized around 1350 BC, yet its content is much older. Medical papyri were the precious property of doctors who passed the scroll to their heirs. As subsequent generations of doctors gained further knowledge, new information was added to the heirloom. A new sheet of papyrus would be used when the older one was full, or was crumbling. A scribe would then transcribe the material from the old sheet onto the new sheet. This was also the time to add new material, rearrange

the old material (e.g. by subject), or to compile smaller texts into one. This practice explains why medical papyri contain material from different ages, as attested by the *Edwin Smith Surgical Papyrus*, and from other medical papyri as attested by the cross references between the *London Medical Papyrus* and the *Ebers Papyrus* [1].

### **The composition of the *London Medical Papyrus***

Subdividing the document into sections ought to reflect the documents that were transcribed onto the existing sheet of the *London Medical Papyrus*, and thus provide a chronology of the treatments.

*L1-L14* discuss sundry illnesses such as bone disease and tremor, *L15-L21* refer to burns, and *L22-L23* discuss eye diseases. The next three, *L24-26*, all call upon the primordial Egyptian gods of the Ennead, and treat “internal” matters such as internal burning, a demon (epilepsy?), and the *ukhedu*, which were principles of internal degeneration according to the Egyptians. *L27-L33* are remedies from foreign doctors. There is one more set of sundry diseases, *L34-L45*, dealing with gynecological issues and the ensuring proper healing of wound, and one more set of treatments for burns, *L46-L61*.

The first chronological clue in the text is the small section *L24-L26*, characterized by reference to the Ennead gods and “internal” disorders. Moreover, *L25* states that the manual was found at the time of king Khufu, who ruled around 2600 BC. Given the stylistic differences between *L24-L26* and the rest of the existing text, it stands to reason that these three treatments form a portion that was derived from an archaic text.

The section on foreign treatments (*L27-L33*) offers a second clue. The so-called Twelfth Dynasty and Second Intermediary Period (1917-1567 BC) [14] were a time when

Egypt had numerous contacts with neighboring countries, and immigrants settled in Egypt in large numbers [15]. Additionally, *L32* can be specifically linked to the epidemic that ravaged the northeastern Nile Delta around 1715 BC [14].

The rest of the document, *L1-L23* and *L34-L61*, reflects the style of manuals from the Twelfth Dynasty onwards (1991-1786 BC) as per contemporary medical papyri [1].

Finally, there are two sets of treatments for burns, *L15-L21* sandwiched between sundry (*L1-L14*) and eye (*L22-L23*) diseases, and *L46-L61* placed after a set of sundry diseases (*L34-L45*). Given the practice of combining texts, the presence of two sets for one ailment implies the pooling of two earlier documents. Thus, it stands to reason that *L1-L23* formed a unit, and included treatments of burns. Similarly, *L34-L61* also formed a manual, which also included its own list of prescriptions for burns.

All four aforementioned treatments are quoted in the medical document *Ebers Papyrus*. *L47* and *L48* are *Ebers 499* and *Ebers 500*, while *L52* and *L56* are so similar that *Ebers 504* is crosslisted for both of them. The *Ebers Papyrus* was finalized around 1550 BC, which means that any material common with that papyrus reflects treatments that already existed in 1550 BC, thus dating *L47-L48*, *L52*, and *L56* to a time compatible with the Santorini eruption.

## **Conclusion**

The *London Medical Papyrus* lists 61 treatments, 23 of which (38%) describe prescriptions for burns, and at least five of which reflect an Egypt dusted with volcanic ash at the time Santorini erupted in the Bronze Age. A similar scenario is described in the Bronze Age Egyptian document *The Admonitions of an Egyptian Sage*, which presents an

Egypt whose waters were red and undrinkable, and in which the white clothes of the inhabitants were inexplicably stained [16].

Recent studies of large eruptions show that volcanic aerosol persists for a long time in the air after the eruption, triggering weather anomalies as the dust shields the area below from sun rays. For instance, Mt. Pinatubo in the Philippines exploded in June 1991 with a Volcanic Explosivity Index of 6, similar to Santorini's eruption in the Bronze Age. A 16% residual aerosol from the Filipino eruption persisted after 2.5 years, and the relative weather anomalies peaked in mid-1992 [17].

Both the *London Medical Papyrus* and the biblical texts also match the lingering effects of the ash. Thus, the seventh biblical plague describes hail (Ex.9.13-35), an otherwise very rare phenomenon in Egypt, yet fully coherent when considering volcanic-based weather anomalies.

More interestingly is the fact that between the aforementioned insects of the fourth plague, and the hail of the seventh, animals died (Ex.9.1-7) and boils covered the skin of humans and the hide of animals (Ex.9.8-12). Boils are also found in the *London Medical Papyrus*: *L19* treats the formation of *k3k3.w.t* (blisters) at sites of burn. The prescription is fragmentary and mentions *ns-sh* and *shnft*, which unfortunately are not identifiable items. One thing which is certain, though: *L19* was written before 1550 BC, since it is mentioned as paragraph 549 of the *Ebers Papyrus* [1].

Plagues 5 through 7 as well as treatment *L19* can be easily fit into the volcanic scenario from Santorini's eruption. The release of ash from Santorini would have unleashed the first four plagues as per above, requiring treatments such as *L46-L47*, *L52*, *L56* as well as the previously discussed *L55* [3]. Particles still suspended in the air would

have triggered storms over Egypt carrying acidic rain, especially in its very first precipitation. The first such storm killed animals (fifth plague), and the acidified rain associated with the storm caused blisters on the skin of humans, as well as on the hide of animals outdoors (sixth plague). The weather anomalies would have persisted for months, causing hail (seventh plague).

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