



Re: Heindl et al.: The eyes of Oetzi: the Tyrolean iceman mummy (*Ophthalmology*. 2019;126:530)



TO THE EDITOR: We read the Pictures & Perspectives by Heindl et al¹ regarding the eyes of Oetzi, the celebrated Tyrolean Iceman dating back to the 4th millennium BCE. Building on previous studies, the authors mention a “unique view” onto this ancient corpse’s anatomy, thanks to the “natural mummification in the glacier ice,”¹ which has allowed many important discoveries, including the determination of this prehistoric individual’s violent cause of death. Specifically, addressing the issue of the preservation of ocular structures,^{2,3} it is interesting to examine the actual role played by environmental and climate conditions as opposed to purely anatomic characteristics of the tissues themselves.

The available literature shows a consistent presence of ocular structures in mummified remains,² either natural or artificial.³⁻⁶ Twenty-one of 52 Third Intermediate Period (1064–656 BCE) to Graeco-Roman (332 BCE–395 CE) period in Egyptian mummies⁷ revealed preservation of ocular structures exclusively through desiccation in 40.4%.⁴ Similarly, the globes of the eyes with optic nerves and orbital muscles could be identified in the mummified remains of 2 remarkable 18th Dynasty Egyptian dignitaries: Nebiri and the Royal Architect Kha.⁸

The *Korean Mummy Project*, assessing 7 computed tomography scanned mummies, indicates eye structures were likely to have preserved in 4 of 7 (57.1 %) of naturally mummified Joseon Dynasty individuals from the 17th–19th centuries (Shin DH, unpublished data), which approximately equals the number of preserved eye structures in 18th/19th century German crypt mummies (5/10 [50%] individuals) [Nerlich AG, personal communication].

In a series of 23 naturally and 23 artificially mummified Capuchin mummies from Palermo, Sicily, Panzer et al⁵ reported a higher prevalence for the preservation of the bulbs and optic nerves bilaterally, namely in 21 of 23 mummies (6 natural and 17 artificial mummies), yielding a 91.3% figure.

Apparently, this preservative phenomenon has little to do with climate since ocular structures are a common feature of both cold (Alpine glaciers¹), hot and sultry (Atacama desert of Northern Chile,² Peru,³ Northern African desert⁴), hot summer subtropical Mediterranean climate (Sicily⁵), and humid continental regions of the world (South Korea, Germany).

In Oetzi’s case, as in all others, the most likely reason for the preservation of intact ocular globes is to be searched in the eye’s anatomy. The sclera is a tough connective tissue extremely resistant to destruction. Scleral collagen is, in composition and arrangement, more similar to that seen in skin, with wider fibrils and a much more interwoven structure than the cornea.⁶ Dehydration leads to a collapse of the vitreous body and a retraction of the sclera, resulting in a shrunken but compact eye globe. As to the optic nerve, the narrow and compact optic canal and the myelin sheath, whose dry mass is characterized by a high proportion of lipids⁹ act as a protective shield.

In summary, the preservation of eye structures in mummies is independent of region, time period and cause of mummification, but depends on the overall preservation of a mummified human body.

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Financial Disclosures: The authors have no proprietary or commercial interest in any materials discussed in this article.

Available online: November 4, 2019.

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