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Forensic Facial Approximation and Archaeology: the case of *Carmilla*, the «Vampire of Venice»

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Abstract. In 2006 an archaeological excavation on Lazzaretto Nuovo Island (Venice, Italy) uncovered an anomalous grave dated by stratigraphic evidence to the 1576 plague pandemic. The human remains (ID 6) were interred with a brick placed in the mouth, indicative of historical practices against «undead» and vampires. A multidisciplinary study incorporating forensic, anthropological, folkloric, and chemical analyses reconstructed the life and death of this individual, informally named *Carmilla*. Facial approximation, performed using rigorous forensic techniques on a 3D-printed replica of the skull, brought *Carmilla*'s visage to life for a National Geographic documentary. This comprehensive investigation underscores the integration of various scientific disciplines to demystify historical superstitions, shedding light on the societal reactions to plague pandemics and the resulting folklore. The case of *Carmilla* exemplifies how forensic science and archaeology can collaboratively reconstruct and humanize historical narratives, providing profound insights into the cultural and biological history of past populations. The study demonstrates the importance of using interdisciplinary approaches to understand the complexities of human history and superstitious beliefs.

Keywords: forensic anthropology, facial reconstruction, superstitions, anomalous burial, revenant.

In 2006, an anomalous grave was discovered during an archaeological excavation conducted with the authorisation of the Soprintendenza per i Beni Archeologici del Veneto-Nucleo NAUSICAA (Italy) in the cemetery of Lazzaretto Nuovo Island (Venice, Italy). The partial human remains (ID 6) were truncated at the level of the humeri midshafts due to interments during the plague of 1630. The stratigraphic data and the finding of devotional

medals coined on the 1600 Jubilee associated with the remains from more recent archaeological levels suggest that the individual dates back to the 1576 plague pandemic (Nuzzolese and Borrini, 2010).

The first account of the importance of the remains as evidence of a superstitious practice against «undead» and vampires was presented at Società Italiana di Antropologia ed Etnologia in 2008 (Borrini, 2008a). Contributions covering various aspects of the grave and the remains have then been presented at European (Borrini, 2008b) and American conferences (Nuzzolese and Borrini, 2009; Borrini *et al*., 2011).

The anomalous burial and the link with superstitious beliefs

The main trait that characterised the burial as anomalous is the intentional deposition of a piece of brick inside the mouth of the deceased. A detailed analysis of the historical context, the stratigraphy, and the anthropological evidence (Borrini and Nuzzolese 2012) dissipated doubts regarding the act's intentionality. The brick was placed into the mouth of the individual when the grave was accidentally reopened to inhumate another subject (ID 1); when this action was performed, ID 6 was not fully skeletonised as demonstrated by the preservation of several articulations, such as the temporomandibular, the cervical, the sternum-clavicle, and the humeral-scapular joints (Duday, 2005; Mallegni and Rubini, 1994; Canci and Minozzi, 2005). In addition, the verticalisation of the left clavicle and medial rotation of both humeri suggested the individual had been wrapped in a shroud (Canci and Minozzi, 2005; Duday and Guillon, 2006) before the inhumation in a simple grave, without any coffin.

The manipulation of a decomposing body accidentally exhumed during an epidemic must have been done under a powerful compulsion and motivation, which the beliefs in vampires and revenants can explain. Ancient reports about vampire disinterment (Dogheria, 2006) have been analysed thoroughly elsewhere (Barber, 1988; Borrini, 2011a), demonstrating how the misinterpretation of decomposition stages led to the rise of vampire mythology. It is crucial to comprehend the limited thanatological knowledge during the peak of the vampire «epidemic», from the 16th to 18th century. The population has experienced only early post-mortem changes, limited to immediate and consecutive abiotic phenomena (e.g. *rigor* and *algor mortis*), which leave the deceased's features almost unaffected. The remaining decomposition and putrefaction phenomena were concealed within the grave, usually hours or days after death. Even physicians and artists were only familiar with fresh bodies for their anatomical studies, so the observation of a deceased person was limited to the first few hours after death or, lately, after years when the

body had already been reduced to a skeleton.

The link between vampires' belief, exhumations and epidemics is well summarised by Barber (1998): «*A vampire might be defined as a corpse that comes to the attention of the populace at a time of a crisis and is taken for the cause of that crisis*». Even if disinterment was relatively infrequent before modern days, it occurred when it was necessary to find an explanation for unforeseen mass deaths, adopting an attitude similar to the modern search for the patient zero. Following the assumption *post hoc ergo proper hoc*, people were exhuming those who died in the early stages of the unknown disease outbreak. As time passed, it was usually sufficient to reach the bloating stage of decomposition, as demonstrated among the other ancient reports by the data on post-mortem modifications and time since death presented in the *Visum* et *Repertum* (Flückinger, 1732). The unfamiliar and unpleasant cadaveric modifications were interpreted as a sign of a malevolent force: the cadaver was seen as a monstrous creature and, as such, interpreted as responsible for the even more monstrous and malevolent phenomenon that was striking the community, the unexplained contagion. This concatenation of events and superstitious interpretations is probably one of the best examples of post hoc fallacy and how «The Sleep of Reason Produces Monsters».

According to this explanation, there was no link between who the person was when alive and their post-mortem transformation into a vampire. Even though some superstitions (Lorey, 1998) suggested a connection between gender, occupation or a person's behaviour and supernatural figures (e.g. witches or werewolves), the identification of a vampire typically occurred independently. As mentioned, it happened following a disinterment and was based on the stage of decomposition exhibited by the body at the time of exhumation.

Significantly, according to folklore, there was a species of vampire considered responsible for plague spreading, a bulimic undead that spent eternity gnawing the funerary cloths inside the grave (Rohr, 1679; Ranft and Cleemann, 1725; Hertz, 1862). Again, for the recounts about this kind of revenant, an explanation is provided by modern thanatological and forensic knowledge. It is reasonable to imagine how the burials were often rushed to manage the daily death toll during the plague, with the use of shrouds in place of coffins and bodies stacked and piled on top of each other in mass graves. In the event of accidental exhumation or reopening of a mass grave, it was possible to unearth a decomposing body still wrapped in its shroud. Due to the higher bacterial content in the oral cavity, the burial clothes could be destroyed exclusively around the mouth, where they had penetrated due to the lack of rigor mortis and the pressure of the sediment directly covering the body, not stopped by any coffin. Falling into the same post hoc fallacy

seen for the other cases of alleged vampires, XVI-XVII century gravediggers conceived the shroud was torn by the «horrible and monstrous chewing» (Rohr, 1679) of the *nachzehrer*, who was engaged in their usual funeral and pestilential bulimia. Relevant for the case of ID 6 is the traditional method reported for stopping the action of this peculiar vampire: a stone, a brick or an object shoved inside their mouth «*alii hoc medium non satis tutum rati, etiam mortuo, priusquam ejus os claudatur, lapidem et nummum pununt in ore, ut si in sepulcro mordere incipiat, lapidem et nummum inveniat, et ab esu abstineat*» (Rohr, 1679).

In conclusion, the anomalous burial of ID 6 discovered in the cemetery of Lazaretto Nuovo in 2006 could be interpreted as evidence of an exorcism against a vampire, more specifically a *nachzehrer*, due to the intentional placement of a brick, the plague context, and the use of a shroud reconstructed from taphonomical evidence.

Analysis of the remains

With the support of the National Geographic Society (Expedition's Council Grant #EC0424-09), a comprehensive anthropological analysis was conducted on the remains of ID 6 in 2009. The goal was to understand thoroughly this individual's biological history, of whom only the age had previously been estimated at 61±5 years old (Nuzzolese and Borrini, 2010).

A genetic analysis performed at the Centre of Molecular Anthropology for Ancient DNA Studies of the University of Rome Tor Vergata confirmed the individual was a female of European ancestry, as suggested by the general morphology of the skull (Borrini *et al.*, 2011).

Even though only a few skeletal elements were present due to the intersection with a more recent grave (Borrini and Nuzzolese, 2012), additional information for the osteobiography of the individual was achieved also by chemical and genetic analysis. The evaluation of the trace elements contained within the bones (Strontium, Zinc, Magnesium, and Copper), conducted in collaboration with the University of Pisa and Consiglio Nazionale delle Ricerche, evaluated the qualitative and quantitative diet of ID 6 (Borrini *et al.*, 2010; Garofano *et al.*, 2011). The results showed that the woman had an adequate diet, predominantly vegetarian and fish-based, placing her among the ordinary people in a city like sixteenth-century Venice.

Osteophyte formation and deterioration of the left acromioclavicular joint indicate that the individual was used to heavy manual activities, which must have also involved shoulder movements, such as lifting and transporting weights (Capasso *et al.*, 1999). Computerised axial tomography and visual assessment of the skull established that the woman suffered traumatic head

injuries years before her death, perhaps as a result of interpersonal violence or accident. Healed trauma has been recognised on the frontal process of the right maxillae and the superior right side of the frontal bone.

Ultimately, a facial approximation of ID 6 was performed for the international documentary the National Geographic Society produced and as part of the research supported by the Expedition's Council Grant.

Morphometric Examination of the Cranium and Mandible

The measurement of the skull has been recorded (Tab. 1) following a forensic protocol (Borrini, 2011b), and the most relevant craniometric indices have been calculated (Tab. 2).

Measurement name	**Borrini 2022**	**Martin & Saller**	**mm**
maximum length of the neural skull	1.1. 1	MS 1	187
glabella-inion length	1.1.2	MS 2	182
glabella-lambda length	1.1.3	MS 3	181
cranial base length	1.1.4	MS 5	108
maximum neurocranial breadth	1.1.5	MS 8	144
biauricular breadth	1.1.6	MS 11	121
biasterionic diameter	1.1.7	MS 12	116
bimastoid breadth of the cranial base	1.1.8	MS 13	100
basion-bregma height	1.1.9	MS 17	132
total height	1.1.10	MS 18	131
porion-bregma height	1.1.11	MS 20	115
porion-vertex height	1.1.12	MS 21	116
horizontal cranial circumference	1.1.13	MS 23	(525)
horizontal cranial circumference above-ophryon	1.1.14	MS 23-a	(524)
transverse curve	1.1.15	MS 24	315
total longitudinal arch	1.1.16	MS 25	376
nasion-bregma arch	1.1.17	MS 26	132
parietal longitudinal arch	1.1.18	MS 27	127
occipital arc	1.1.19	MS 28	117
nasion-bregma chord	1.1.20	MS 29	110
bregma – lambda chord	1.1.21	MS 30	116
lambda-opisthion chord	1.1.22	MS 31	99
foramen magnum length	1.1.23	MS 7	31
foramen magnum breadth	1.1.24	MS 16	28
length of the face	1.2.1	MS 40	101
minimum frontal breadth	1.2.2	MS 9	102
maximum frontal breadth	1.2.3	MS 10	120
upper facial breadth	1.2.4	MS 43	106
bizygomatic facial breadth	1.2.5	MS 45	(126)
maximum bimaxillary breadth of the midface	1.2.6	MS 46	(91)
morphological height of the face	1.2.7	MS 47	124
height of the upper face	1.2.8	MS 48	68
biorbital breadth	1.3.1	MS 44	99

interorbital breadth from dakryon	1.3.2	MS 49-a	25
interorbital breadth	1.3.3	MS 50	27
orbital breadth	1.3.4	MS 51	41
orbital height	1.3.5	MS 52	34
nasal breadth	1.4.1	MS 54	27
nasal height	1.4.2	MS 55	53
nose-malar chord	1.4.3	MS 44-a	101
nose-malar breadth	1.4.4	MS 44-1	111
maxillo-alveolar length	1.5.1	MS 60	58
maxillo-alveolar breadth	1.5.2	MS 61	--
palate length	1.5.3	MS 62	47
palate breadth	1.5.4	MS 63	40
bicoronoid breadth of the jaw	1.6.1	MS 65-1	97
bigoniac breadth	1.6.2	MS 66	90
bimental breadth	1.6.3	MS 67	44
length of the mandibular body	1.6.4	MS 68	(102)
projected length of the mandible	1.6.5	MS 68-1	(72)
symphysial height of the chin	1.6.6	MS 69	35
corpus mandibulae height	1.6.7	MS 69-1	32
height of the corpus mandibulae to the 2nd molar	1.6.8	MS 69-2	28
thickness of the corpus mandibulae	1.6.9	MS 69-3	14
condylar height of the ramus	1.6.10	MS 70	50
minimum ramus breadth referred to the height	1.6.11	MS 71	35
minimum ramus breadth	1.6.12	MS 71-a	36
mandibular angle	1.6.13	MS 79	115

Tab. 1. *Craniometric measurements of ID 6. Measurements have been recorded using Martin and Saller (1957) standard code and a new univocal numeric system (Borrini, 2022).*

Index	Martin & Saller (1957)	Borrini (2022)	Value	Meaning
Cranial	8/1	1.1.5/1.1.1.	77	Mesocrany[1]
Vertico-Longitudinal	17/1	1.1.9/1.1.1	70.5	Orthocrany[1]
Vertico-Transcerse	17/8	1.1.9/1.1.5	91.6	Tapeinocrany[1]
Vertico-Auricular	20/1	1.1.11/1.1.1	61.5	Orthocrany[1]
Transversal Vertico-Auricular	20/8	1.1.11/1.1.5	79.9	Tapeinocrany[1]
Transverse Fronto-Parietal	9/8	1.2.2/1.1.5	70.8	Eurymetopy[1]
Transversal Facial	9/10	1.2.2/1.2.3	85	Large[1]
Total Facial	47/45	1.2.7/1.2.5	98.4	Hyperleptoprosopic[1]
Upper Facial	48/45	1.2.8/1.2.5	53.9	Mesene[1]
Gnatic	40/5	1.2.1/1.14	93.5	Orthognathous[2]
Nasal	54/55	1.4.1/1.4.2	50.9	Mesorrhiny[1]
Orbital	52/51	1.3.5/1.3.4	82.9	Mesoconchy[1]
Palate	63/62	1.5.4/1.5.3	85.1	brachistaphylin[1]
Jugo mandibular	66/45	1.6.2/1.2.5	71.4	Narrow jaw and large face[3]
Transverse Cranio-facial	45/8	1.2.5/1.1.5	87.5	Narrow face and large skull[3]
Jugo frontal	9/45	1.2.2/1.2.5	80.9	Narrow forehead and large face[3]
Foramen magnum	16/7	1.1.24/1.1.23	90.3	Large[4]

Tab. 2. *Cranial indices calculated on ID 6. The meanings of the values have been interpreted from Hug 1940 (1), Martin and Saller (2), Kumar 2022 (3) and Facchini 1988.*

Metrically, the cranium appears to be generally proportionated (mesocranic and orthocranic), more large than tall (tapeinocranic) with a rather large forehead (eurymetopic) and a medium face (mesene). In the splanchnocranium, the nose and the orbits are proportionated (mesoconchy and mesorrhiny) and the palate is short (brachistaphylin). The cranial capacity, calculated with the Lee and Pearson (1901) formula for the basion-bregma height is 1366 cm^3, corresponding to a relatively large volume (aristencephalic) according to Sarasin classification for female individuals (Corrain, 1996).

General morphological characteristics have been systematically assessed visually as follow.

Cranium

Norma verticalis

The neurocranium is of average size and ovoid shape with cryptozighia. The temporal *fossae* are very shallow due to the absence of a post-orbital constriction, and no notable parietal crests are extending from them. Both *tubera frontalia* and *parietalia* are indistinct. The cranial sutures are fused and in the process of obliteration, particularly the *sutura sagittalis*, though their paths can not be described in detail (Martin and Saller, 1957 I, 510). Wormian bones are absent.

Norma Lateralis

The cranial vault is average height with a continuous sagittal arch; the *vertex* is immediately anterior to the *bregma*. The forehead is straight and relatively vertical, with a type 2 *glabella* (*ibid*. II, 1327). The *tubera frontalia* are faint and not appreciable, just as the *arcus superciliares* and the *ophryon* groove are unremarkable. The nasal spine is type 2 (Broca in Martin and Saller, 1957 II, 1414); a very slight prognathism of the alveolar region is noted. The *linea temporalis superiori* and *inferior* are unquestionably light and not observable along their entire course; the shape of the *pterion* is type «a» on both the right and left sides (Martin and Saller, 1957 II, 1341); the squamous suture is closed but visible and rounded on both sides of the skull.

The zygomatic arch (preserved only on the left side) is moderately thin, and the root of the zygomatic process of the temporal bone remains palpable beyond the meatus, albeit with a horizontal course, reaching the edge of the temporal bone; the mastoids are small, smooth, and rounded. The auditory meatus has a type 1 shape (*ibid*., 1341); the occipital squama is slightly calcaneal; the external occipital protuberance is barely marked and can be classified as type 1 (*ibid*., 1300).

Norma Frontalis

The cranium does not present a metopic suture; the forehead is moderately small, devoid of a supraglabellar transverse groove, supraorbital ridges, and prominence of the glabellar region. The *tubera frontalia* are barely noticeable.

The face is moderately proportionate and normal-sized; the nasal root appears relatively narrow, with nasal bones close to type 3 (*ibid*., 1049). The nasal spine is discernible, positioned below a piriform aperture similar to type 3 (Hovorka in Martin and Saller, 1957, II, 1414). The lacrimal canals are very patent, set in roundish orbits that are moderately spaced with a slight inclination of the upper margin, which is thin and sharp to the touch. The right side is slightly lower than the left. The supraorbital notch closes into a small foramen on both sides. The infraorbital *foramina* are moderately large. The zygomatic area is of medium size and slightly receding backwards, the *incisive fossae* are relatively deep, and the *canine fossae* are discernible. No maxillary *torus* is present, and the submalar curvature is type 2 according to Sergi *corporis maxillae* classification (1947).

Norma Occipitalis

The cranial vault exhibits a «house» shape with nearly vertical walls, with the maximum width distinguishable at the *tubera parietalia*, that are evident; no senile depressions are noted. The *linea nuchalis suprema*, moderately curved, is quite pronounced near the *protuberantia occipitalis externa*, which is rather noticeable and rounded in shape.

Norma Basalis

The alveolar arch, devoid of a *torus*, is paraboloid in shape, as is the dental arch. The malar bones offer a rather smooth edge; the posterior nasal spine is evident; the *foramen magnum* is modest in size, nearly round, and flanked by rather small occipital condyles moderately inclined towards the palate. The prominence of the *protuberantia occipitalis externa* is visible; the *linea nuchalis superior* is visible, unlike the *inferior*; the muscle attachments for the *rectus capitis posterior major* and *minor* are not appreciable. The mastoids are tilted and smooth; the digastric notch is evident on both sides.

Mandible

Anterior view

The *protuberantia mentalis* is insignificant, classifiable as type 1 (Schulz 1933, 338); the *gonia* show no eversion; the mental *foramina* are visible and positioned between the first and second premolars; the inferior margin is smooth and continuous with a slight elevation at the canines.

Lateral view

The chin is barely protruding; the *rami mandibulae* are rather short and wide, ending in a gonion of morphology I (*ibid*., 335). The *processus coronoideus* is relatively low, though it surpasses the *processus condylaris*, and wide, acquiring a type I morphology (*ibid*., 315); the sigmoid notch appears round and moderately deep, resembling type 1 (*ibid*., 314).

Superior View

The alveolar arch, as well as the dental arch, are paraboloid in shape; the *corpus mandibulae* is moderately developed. The chin is not prominent; the *spinae mentalis* are well-developed, especially the superior ones. There is no mandibular *torus* present.

Posterior View

The *rami* are convergent at the *gonia*, which show a very slight eversion with an intermediate morphology between types 2 and 3 (*ibid*., 333); on both sides, the *mandibular foramen* is evident and bordered anteriorly by a pointed *lingula*; there is no mylohyoid bridge present, the *linea mylohyoidea* is barely perceptible, and the *foveae submandibularis* are faint.

The facial approximation

Forensic facial approximation aims to outline the physical features of an unidentified subject by combining artistic and anatomical techniques on the deceased's skull to aid their recognition by relatives (Gibson, 2008). It is essential to clarify that this is not an identification method (ANSI, 2020) but only an *extrema ratio* tool that can assist forensic investigators in the search for potential identification candidates. The remains' identity must be confirmed or excluded via genetic, anthropological, or odontological analysis.

Forensic facial approximation techniques can also be applied to historical or archaeological remains to recreate the facial features of individuals from different periods. Beyond their scientific value, these reconstructions hold a unique power in archaeological research. They help to understand the physical characteristics of ancient populations, and notably, they engage the public, offering visual representations of individuals from the past, breathing life into history (Borrini, 2023).

The reconstruction was sculpted on an exact replica of the ID 6 skull. It is central to emphasise that any scientific facial approximation must be done on a accurate copy of the original skeletal evidence, as this is usually not used due to its forensic or historical value. Access to the original anthropological material and data is not just important, it is imperative. It represents the only

possible approach that produces a scientific and rigorous reconstruction and to avoid unnecessarily jeopardising the integrity of the evidence, as stated by current international forensic standards (ANSI/ASB, 2020). The copy was produced by acquiring the surface of the cranium and the mandible with a Konica Minolta Konica Minolta Range-7 laser scanner, with triangulation light block method and accuracy ±40μm. The data was then processed, and the replica was prototyped using a Stratasys Dimension Elite Performance 3D Printer in ABSplus production-grade thermoplastic (Layer Thickness 0.254 mm). Two materials, one for the bone and one for the support necessary during the printing, have been heated in an extrusion head and deposited in 0.254 mm thin layers. When the model has been completed, the support material has been removed.

The cranium and mandible were articulated (Anderson, 1983), with a provision for the physiological space occupied by the cartilage and the articular disk in the temporomandibular joint. Care was also given to space the maxillary and mandibular teeth, which in a living individual are generally not clenched together (Taylor, 2001).

The prepared skull was then positioned on the Frankfort Horizontal Plane, accurately aligning the lower margin of the orbit (*orbitale*) with the most lateral point of the roof of the external meatus (*porion*). This anthropological standard represents the normal position of a face-forward standing subject with the gaze directed at the horizon.

Photographs of the skull in this anatomical position were taken in a frontal (*norma frontalis*) and lateral view (*norma lateralis*) with a Nikon D90. Following forensic guidelines (Reis, 2007), the pictures have been scaled and printed life-size (1:1) to offer an additional reference during the reconstruction process, while the skull replica was progressively covered with plasticine. In addition, the profile picture was also used to delineate the nasal profile.

A preliminary step in the facial approximation and sculpting procedure is estimating the thickness of the soft tissues in specific facial landmarks. This was achieved by combining the subject's biological profile and the skeletal features, using as reference the values published by Helmer (1984) for European females above the age of 60 with average body build.

When the depth markers were fixed to the skull replica on the relevant landmarks (Taylor, 2001), the facial approximation could start, keeping the 1:1 pictures and the original skull on the side as a constant, essential reference.

The position of the nasal tip has been calculated using a geometric method (Gerasimov, 1971; Gerasimov, 1975) that takes into consideration the projection of the last third of the nasal bones and the continuation of the nasal spine (Wilkinson, 2004). The lateral profile has been outlined projecting the lateral edge of the piriform aperture on the tangent to the apex of the

nasal bones, parallel to the nasion/prosthion line (Lebedinskaya *et al.*, 1993; Prokopec and Ubelaker, 2002). The profile was drawn on the life-size lateral picture, cut on sturdy cardboard and transferred on the cast to guide the sculpting procedure.

Before starting to sculpt the features, a 24 mm prosthetic eyeball was placed in the centre of each orbit, with the outer point of the iris deeper than the line running from the superior and inferior margin of the orbit (Wilkinson, 2004), in consideration of the advanced age of the individual (Taylor, 2001).

Adopting the American or Gatliff method (Gibson, 2008), the first step in general modelling of the soft tissues on the skull's replica consisted of connecting the depth markers with uniform strips of plasticine that functioned as large-scale tissue deep markers (Fig. 1) in what can be classified as a technical phase (Taylor, 2001). More detailed sculpting began to recreate each anatomical units when the general profile had been approximated.

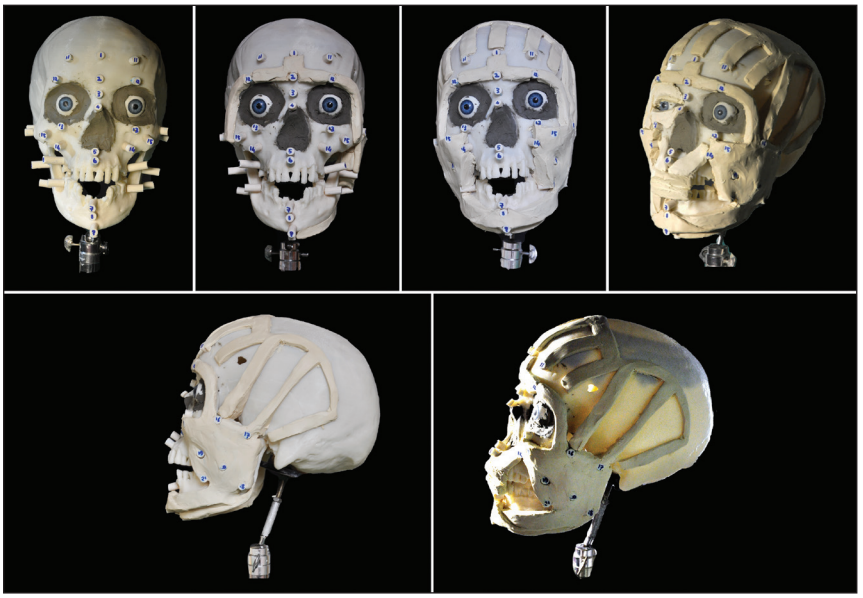

Fig. 1. *Steps of the technical phase where the depth markers are connected with uniform strips of plasticine.*

The orbital region was modelled, considering that the medial canthus is three to four millimetres inward of the malar tubercle and the lateral two millimetres inward from the lacrimal crest (Angel, 1978). The shape of the upper eyelid fold mirrored the general outline of the orbital margin, which also served as a reference point for eyebrow tracing (Fedosyutkin and Nainys, 1993).

The mouth area has been reconstructed based on the position and dimension of the central elements of the dentition (Wilkinson *et al*., 2003), namely the upper and lower incisors and canines. The horizontal lip opening has been traced where the maxillary canines' distal surface meets the first premolar's mesial surface (interdental space). After fixing the position of the midpoint of the oral fissure (*stomion*) close to the lower third of the central maxillary incisors (Ferrario *et al*., 2000), the vertical thickness of the lips has been calculated on the height of the enamel of the upper central incisors only, as the mandibular ones have been lost *post mortem*. While modelling the facial tissues around the lips, particular attention has been given to making the nasolabial fold visible, not only according to the age of the individual but also to the depth of the canine fossae (Fedosyutkin and Nainys, 1993).

Finally, to complete the general facial features following the deep markers and the cranial substructures (Gibson, 2008), the approximation has been provided with neck and earlobes (Civardi, 2002) to provide the whole reconstruction with a natural appearance. The neck was modelled following the nuchal lines and the development of mastoids; the clavicle barely visible at the end of the neck was modelled according to the original from the skeletal remains.

Upon completing the sculpting procedure, the plasticine model (Fig. 2) underwent scanning and prototyping using the same equipment to create the skull's replica. This process was implemented to ensure a robust reconstruction and to better align with the requirements for the National Geographic documentary. The ABS bust was then painted to give it a realistic appearance, adding realistic eyelashes, eyebrows, and high-quality glass eyes (Fig. 3). The green colour for the iris has been chosen considering the European ancestry of the individual and the lack of other relevant; it could be considered a good practice to use an intermediate eye colour when there is no genetic or ancestral information, avoiding the extremes of the range (light blue and dark brown). Hairs have been added to improve the realism of the approximation: a wig has been modelled by Mauro Audello atelier (Tourin) according to the hairstyle of the epoch, as depicted by Cesare Vecellio in *De gli habiti antichi et moderni* (1498). Specifically, the style of women called «Hortolane» (greengrocers) has been selected in consideration of the social status reconstructed following the palaeodiet analysis (Borrini *et al*., 2010; Garofano *et al*., 2011).

Figg. 2-3. *The final result of the sculpting procedure with plasticine (left) and the completed reconstruction of ID 6: the plasticine model has been scanned and 3D printed with ABS, painted and finished with realistic eyelashes, eyebrows, high-quality glass eyes and hairs (right).*

Conclusions

The facial reconstruction of ID 6 from Lazaretto Nuovo Island, known as the «Vampire of Venice», or more affectionately referred to as *Carmilla* after the first female vampire in literature, represents the closing of a multidisciplinary study (Fig. 4).

The entire investigation of these remains demonstrates how different sciences can contribute to reconstructing complex matters, such as the beliefs in vampires. Forensic science, chemistry, anthropology, history, genetics and taphonomy cooperated for a holistic approach to better understand vampire superstitions' birth, development and spread.

Most importantly, this study outlines a promising approach for anyone studying historical cultures: superstitions and beliefs should not be quickly disregarded as irrational ancient folklore or instances of mass hysteria. Instead, they should be viewed as intriguing riddles that can be solved with nowadays advanced knowledge.

Finally, the multidisciplinary approach behind the study of *Carmilla* pictured in the National Geographic documentary, which culminated with the facial approximation of the individual, proves how the cooperation between sciences and archaeology can give voice to unnamed individuals: people who did not leave a memorable imprint in history but whose lives and stories can nowadays be narrated, helping us better understand our past.

Fig. 4. *The final reconstruction of Carmilla on the side of the original skull.*

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