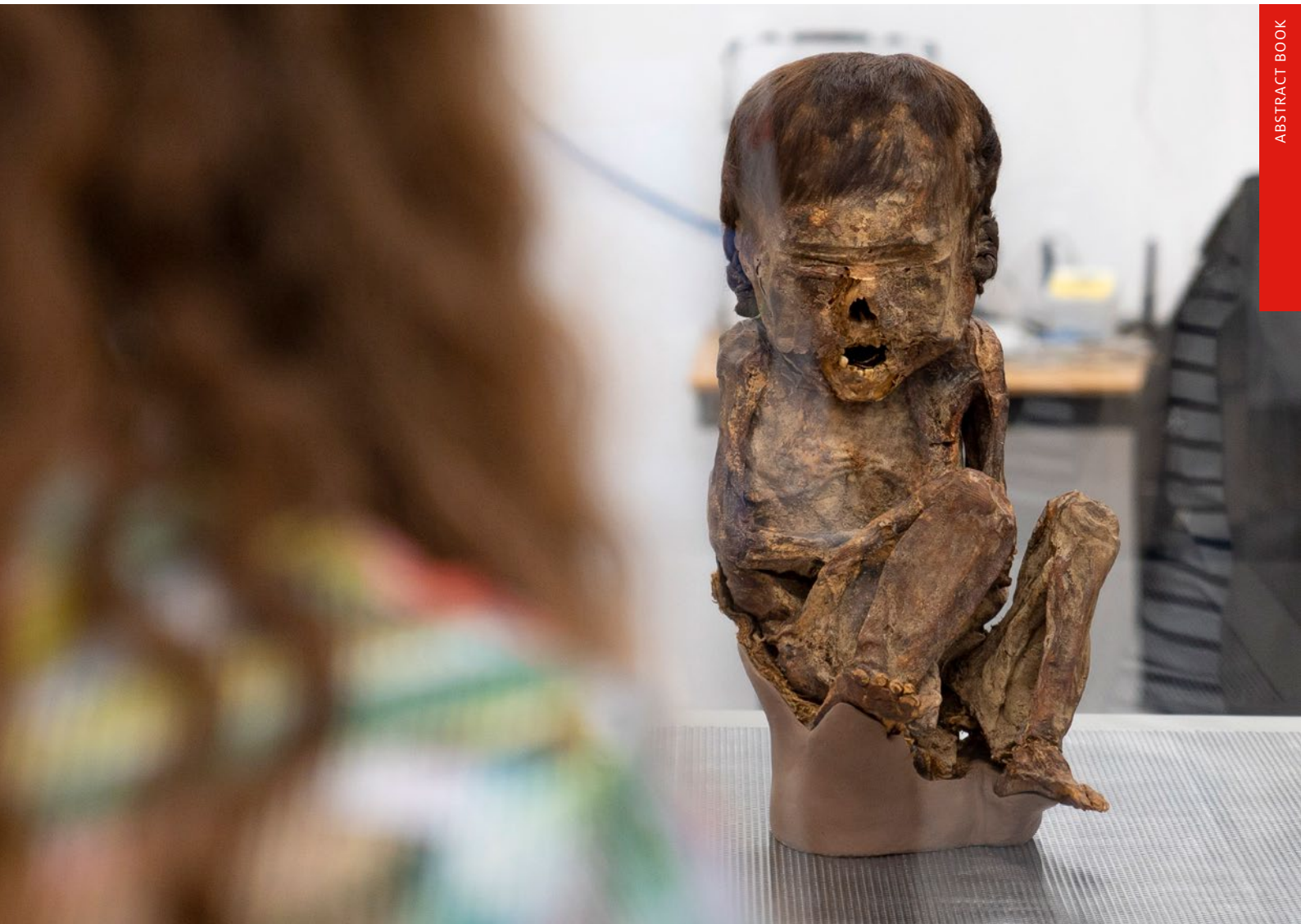
eurac research

WMC 2022

Abstract Book

10th World Congress on Mummy Studies

Bolzano, Italy | 05–09 September 2022



SCIENTIFIC COMMITTEE

ALBERT R. ZINK
PRESIDENT OF THE ORGANIZING COMMITTEE - CHAIR
Eurac Research
Institute for Mummy Studies
Bolzano, Italy

CONRADO RODRÍGUEZ MARTÍN
PRESIDENT OF THE WORLD MUMMY CONGRESS
Instituto Canario de Bioantropología
Tenerife, Islas Canarias, Spain

NIELS LYNNERUP
PRESIDENT OF THE SCIENTIFIC COMMITTEE
University of Copenhagen
Department of Forensic Medicine
Copenhagen, Denmark

SALIMA IKRAM
APPOINTED MEMBER
American University in Cairo
Department of Sociology, Egyptology and Anthropology
Cairo, Egypt

JANE E. BUIKSTRA
APPOINTED MEMBER
Arizona State University
School of Human Evolution and Social Change
Arizona, USA

FELIPE CÁRDENAS-ARROYO
APPOINTED MEMBER
COLOMBIAN INSTITUTE OF ANTHROPOLOGY AND HISTORY
Bogotá, Colombia

ORGANIZING COMMITTEE

INSTITUTE FOR MUMMY STUDIES
ALBERT R. ZINK • FRANK MAIXNER • GIOVANNA CIPOLLINI • VALENTINA COIA • MARCO SAMADELLI • ALICE PALADIN • MYRIAM FLORENCE CROZE • ALEXANDRA MUSSAUER • GUIDO VALVERDE • CHRISTINA WURST • HEIDI YOKO JÄGER • MOHAMED SABRY SARHAN • STEFANIA ZINGALE • MANUELA MILAN • RENATE CASSAR

MEETING MANAGEMENT

VERENA ZUBLASING

10th World Congress on Mummy Studies
WMC 2022

4th Bolzano Mummy Congress
05-09 September 2022
Bolzano, Italy

Contents

SESSION 13: Museums & Conservation 103

SESSION 14: Funerary Archaeology & Imaging 110

SESSION 15: Mummy Exhibition 117

POSTER SESSION 119

Scientific program

Monday, 5 September 2022

09.00 – 09.30		**Conference opening** Roland Psenner: Welcome address Albert Zink: Introduction
09.30 – 10.45		**Session 1: Iceman** **Chair: ALBERT ZINK**
09.30 – 09.45	**A 01**	Weber, Jochen et al.: Medical aspects of Ötzi's arrow wound: how long did he survive the trauma?
09.45 – 10.00	**A 02**	Lynnerup, Niels et al.: Ötzi: new 3D visualizations of the wound of the left shoulder
10.00 – 10.15	**A 03**	Pernter, Patrizia et al.: Computed tomography as a noninvasive tool for long-term control of the preservation of the Iceman
10.15 – 10.30	**A 04**	Wang, Ke et al.: High coverage genome of the Tyrolean Iceman reveals high Anatolian farmer ancestry
10.30 – 10.45	**A 05**	Croze, Myriam et al.: Reconstructing genomic and social structure of prehistoric individuals from the eastern Italian Alps
10.45 – 11.15		*Coffee break*
11.15 – 12.45		**Session 2: Biomedicine & Paleoparasitology** **Chair: FELIPE CÁRDENAS-ARROYO**
11.15 – 11.30	**A 06**	Rodríguez-Martín, Conrado et al.: Paleoimaging of Guanche mummies
11.30 – 11.45	**A 07**	Ejsmond, Wojciech et al.: Pregnant ancient Egyptian mummy – state of the research and further plans
11.45 – 12.00	**A 08**	Eppenberger, Patrick et al.: Evolutionary implications of elongated vascular calcinosis in the mummified forearm of the 4400-year-old probable remains of King Unas
12.00 – 12.15	**A 09**	Maixner, Frank et al.: Microscopic evidence for malaria infection in visceral tissue of the Medici family
12.15 – 12.30	**A 10**	Gurjão, Ludmila et al.: Next Generation sequencing applied to coprolites of Gruta do Gentio II archaeological site, Southeast Brazil.
12.30 – 12.45	**A 11**	Iñiguez, Alena et al.: Technological innovation in paleoparasitology in Brazil: preliminary outcomes
12.45 – 13.45		*Lunch*

13.45 – 15.30		**Session 3: South American mummies – Imaging and Bioarchaeology** **Chair: CONRADO RODRÍGUEZ MARTÍN**
13.45 – 14.00	**A 12**	Buikstra, Jane: ONE Paleopathology: globalizing the study of ancient health
14.00 – 14.15	**A 13**	Valverde, Guido et al.: The Bolivian Mummy Project – Different lines of scientific evidence for the study of pre-Columbian mummies at museums
14.15 – 14.30	**A 14**	Wilson, Andrew et al.: Llullaillaco child mummies: bioarcheology context_ part 1
14.30 – 14.45	**A 15**	Villa, Chiara et al.: Llullaillaco child mummies: 3D documentation and imaging analysis _part 2
14.45 – 15.00	**A 16**	Watson, Lucia et al.: Mummies as Microcosms: analysis of mummy bundles from the central coast of Peru (1100 AD-1532 AD) using computed tomography
15.00 – 15.15	**A 17**	Fuentes, Sarita et al.: The city of the Living and the Dead: Bioarchaeology and our understanding of the site of Pachacamac, Peru - 120 years of history
15.15 – 15.30	**A 18**	Socha, Dagmara et al.: The toxicological analysis of Nazca mummies.
15.30 – 16.00		*Coffee break*
16.00 – 17.30		**Session 4: Atherosclerosis & Imaging** **Chair: NIELS LYNNERUP**
16.00 – 16.15	**A 19**	Thompson, Randall et al.: Atherosclerosis in ancient mummies: The HORUS study of 268 adult individuals
16.15 – 16.30	**A 20**	Antoine, Daniel et al.: Cardiovascular disease in Nile valley mummies: exploring the need for a more systematic approach that accounts for vessel prevalence and the impact of Dual Energy CT scanning
16.30 – 16.45	**A 21**	Wurst, Christina et al.: Atherosclerotic cardiovascular disease in mummies - A polygenic risk score based on a genetic enrichment approach
16.45 – 17.00	**A 22**	Thomas, Gregory et al.: Atherosclerosis in Arctic mummies despite consumption of a marine based diet high in omega-3 fatty acids
17.00 – 17.15	**A 23**	Badr, Ibrahem: New reading in ancient mummification technique by using CT scan as non-destructive tool for mummies examination applied on Tjanefer mummy (H-3rd Intermediate, Dynasty 21)
17.15 – 17.30	**A 24**	Vetter, Luisa et al.: Metal offerings and the mummy: the analysis of the contents of funerary bundles from the central coast of Peru (1100d.C-1532d.C) based on CT-Scans
18.30 – 20.30		***The South Tyrol Museum of Archaeology kindly invites to:*** ***Welcome drink and visit of the Iceman exhibition***

Tuesday, 6 September 2022

09.00 – 10.30		**Session 5: Molecular analysis & Imaging** **Chair: JANE BUIKSTRA**
09.00 – 09.15	**A 25**	Nelson, Elizabeth et al.: Synergistic paleopathological analysis of Chachapoya mummified remains, north-eastern Peru
09.15 – 09.30	**A 26**	Granehäll, Lena et al.: Reconstructing the ancient *Helicobacter pylori* genome of an 18th century mummy from Basel, Switzerland
09.30 – 09.45	**A 27**	Boggi, Byron et al.: Multiomic applications in the study of biomolecular preservation and ancient disease discovery
09.45 – 10.00	**A 28**	Lerchi, Andrina et al.: Proteomic profiling of tissues from a medieval Mongolian mummy
10.00 – 10.15	**A 29**	Pedergnana, Antonella et al.: Oral health in Medieval Europe explored through paleoproteomics
10.15 – 10.30	**A 30**	Sarhan, Mohamed et al.: Reconsidering additional sources of ancient DNA
10.30 – 11.00		*Coffee break*
11.00 – 12.30		**Session 6: Egyptian mummies** **Chair: SALIMA IKRAM**
11.00 – 11.15	**A 31**	Rühli, Frank et al.: Sustainable mummy studies: capacity building activities in Egypt
11.15 – 11.30	**A 32**	Hobel, Tina: The Necropolis of the Coptic monastery of St. Paulos (Deir el-Bachît) at Western Thebes, Egypt. State of research and current results
11.30 – 11.45	**A 33**	Lösch, Sandra et al.: The human remains of the Coptic monastery complex in Deir el-Bachît in Thebes-West
11.45 – 12.00	**A 34**	Tatz, Sabrina: Burial patterns and social structures in Late Antiquity. The necropolis of the Paulos Monastery/Upper Egypt
12.00 – 12.15	**A 35**	Mussauer, Alexandra et al.: Four thousand years of maternal ancestry in ancient Egypt illuminated by mitochondrial genome sequencing
12.15 – 12.30	**A 36**	Braulinska, Kamila et al.: Radiological analysis of the Warsaw mummy's alleged pregnancy, with a broader study of the radiological, archaeological and Egyptological context
12.30 – 14.00		*Lunch*

14.00 – 15.30		**Session 7: Imaging, Biomedicine & Conservation** **Chair: GREGORY THOMAS**
14.00 – 14.15	**A 37**	Sutherland, Linda et al.: Medical conditions in ancient people: CT paleopathology pictorial essay in mummies
14.15 – 14.30	**A 38**	Thompson, Randall et al.: Ten ancient mummies with extensive atherosclerosis on CT imaging: a pictorial essay
14.30 – 14.45	**A 39**	Seiler, Roger et al.: Orofacial pathologies in two temporally disjunct population samples in the Temple of Millions of Years of Thutmosis III in Western Thebes, Egypt
14.45 – 15.00	**A 40**	Facchetti, Federica et al.: Mummy of vizir Imhotep: interdisciplinary study and restoration work
15.00 – 15.15	**A 41**	Hartenstein, Cassandre et al.: Study of Egyptian mummies in context. An assemblage of the beginning of 18th dynasty.
15.15 – 15.30	**A 42**	Olivia, Cinzia: Conserving Egyptian mummies: a difficult relationship between past and present
15.30 – 16.00		*Coffee break*
16.00 – 17.30		**Session 8: Museums & Conservation** **Chair: DANIELA PICCHI**
16.00 – 16.15	**A 43**	Jankauskas, Rimantas et al.: Study of Corposanto - relics of St. Bonifatius, Holy Martyr
16.15 – 16.30	**A 44**	Wilkinson, Caroline: Presenting the faces of preserved human remains: ethical, academic and practical challenges
16.30 – 16.45	**A 45**	Peyroteo Stjerna, Rita et al.: Mummification in the Mesolithic. New approaches to old photo documentation reveal previously unknown mortuary practices in the Sado Valley, Portugal
16.45 – 17.00	**A 46**	Silva-Pinto, Verónica et al.: Agency and corporality in the mortuary treatment of Chinchorro infants of the Atacama's coast desert
17.00 – 17.15	**A 47**	Gutierrez Espinola, Donal Mauricio et al.: Conservation process of the mummy from Cajamarquilla, Peru.
17.15 – 17.30	**A 48**	Schotsmans, Eline et al.: Conducting experiments at the Australian Facility for Taphonomic Experimental Research (AFTER) for a better understanding of mummification practices
18.00 – 19.00		***Public lecture*** Ikram, Salima: Egypt's royal mummies: from discovery to display(s)
19.00 – 22.00		**Poster session** Beer & pizza reception

Wednesday, 7 September 2022

09.00 – 10.30		**Session 9: Mummies from Europe, the Near East & North Africa** **Chair: DARIO PIOMBINO-MASCALI**
09.00 – 09.15	**A 49**	Nielsen, Nina et al.: Tollund Man's last meal: new analyses of his colon contents
09.15 – 09.30	**A 50**	Zingale, Stefania et al.: Revealing the "Maronite mummies" of Assi el Hadath cave (Lebanon)
09.30 – 09.45	**A 51**	Silva-Bessa, Angela et al.: An interdisciplinary study on the mummified and skeletonized human remains from three Portuguese cemeteries (19th-21st centuries)
09.45 – 10.00	**A 52**	Alapont Martin, Llorenç et al.: A singular tomb in Pompeii. The inhumation and mummification of Marcus Venerius Secundio
10.00 – 10.15	**A 53**	Metcalfe, Jenefer et al.: Anthropogenic mummification at Koshtamna, Nubia; the evidence from Douglas Derry's archives
10.15 – 10.30	**A 54**	Lunardini, Agata et al.: Unusual artificial mummification in Medieval Italy: The Blessed Illuminata and Chiarella from Montefalco (Perugia, Italy)
10.30 – 11.00		*Coffee break*
11.00 – 12.30		**Session 10: Biomolecular studies** **Chair: FRANK MAIXNER**
11.00 – 11.15	**A 55**	Sharpen, Jack et al.: Mummification modelling: Profiling the biomolecular mechanisms and markers of tissue degradation for archaeological and forensic applications.
11.15 – 11.30	**A 56**	López-Costas, Olalla et al.: Mercury and mummies
11.30 – 11.45	**A 57**	Gaeta, Raffaele et al.: Viral infections in a 16th century Italian infant mummy: a paleo-molecular biology study
11.45 – 12.00	**A 58**	Currò, Aurora et al.: What mummies can reveal us about genetic diseases
12.00 – 12.15	**A 59**	Majchrzak, Lukasz et al.: The multimodal chemical and histological study of the Andean pre-Columbian Chancay mummies
12.15 – 12.30	**A 60**	Fornaciari, Antonio et al.: The mummies of the Basilica of Saint Domenico Maggiore in Naples (XV-XVII centuries): a paleotoxicological approach
12.30 – 14.00		*Lunch break*

14.00 – 15.30		**Session 11: Mummification Methods** **Chair: ANDREW NELSON**
14.00 – 14.15	**A 61**	Rossetti, Chiara et al.: Rehydration recipes and pre analytical choices as a personalized medicine in histopathology of mummified tissues
14.15 – 14.30	**A 62**	Colmenares Prado, Marta et al.: Multiproxy biogeochemical approach of Egyptian mummies balm composition
14.30 – 14.45	**A 63**	Vandenbeusch, Marie et al.: The mummified people from Thebes, Egypt
14.45 – 15.00	**A 64**	Zesch, Stephanie et al.: The multifaceted nature of Egyptian mummification: new insights into child mummies
15.00 – 15.15	**A 65**	Loynes, Robert: The Ptolemaic Period. Pinnacle of Egyptian mummification technique?
15.15 – 15.30	**A 66**	Stark, Robert et al.: Insights to Mummification methods from Theban tombs (TT) 65–67 in the Sheikh Abd el-Qurna Section of the Theban Necropolis at Luxor, Egypt
15.30 – 16.00		*Coffee break*
16.00 – 17.15		**Session 12: Museums & Collections** **Chair: DANIEL ANTOINE**
16.00 – 16.15	**A 67**	Piombino-Mascali, Dario et al.: Celebrating the centenary of Arthur Aufderheide's birth (1922-2022)
16.15 – 16.30	**A 68**	Malgora, Sabina et al.: Application of modern technologies to the study of Egyptian mummies: the case of "Ankhekhonsu" of the Civic Archaeological Museum of Bergamo, Italy
16.30 – 16.45	**A 69**	Milani, Chantal et al.: The Bergamo mummy of Ankhekhonsu: forensic facial reconstruction
16.45 – 17.00	**A 70**	Paasikivi, Sofia et al.: Post Medieval mummies in the Church of Seili, Finland
17.00 – 17.15	**A 71**	Teßmann, Barbara et al.: Lost and found: mummies and bones of the so-called priest tombs from the mortuary cult complex of Ny-User-Ra in Abusir, Egypt
17.15 – 18.15		**General assembly**
20.00 – 23.00		***Conference dinner - Maretsch Castle***

Thursday, 8 September 2022

09.00 – 10.30		**Session 13: Museums & Conservation** **Chair: CAROLINE WILKINSON**
09.00 – 09.15	**A 72**	Manzollino, Roberta et al.: The other face of musealization: 3D computerized reconstruction of the facial features of an Egyptian mummy
09.15 – 09.30	**A 73**	Belvedere, Marianna et al.: Digital fabrication and heritage enhancement: the Pavia mummy copy made by Spazio Geco Fab Lab
09.30 – 09.45	**A 74**	Schraut, Philipp: The archeoParc Schnals museum and the environment of the Schnalstal valley
09.45 – 10.00	**A 75**	Barbero, Enrico: A new exhibition room at the Museo Egizio: Between conservation and display of human remains
10.00 – 10.15	**A 76**	Silva-Pinto, Verónica et al.: Chinchorro transcend death: the usefulness of CT scan for the construction of mummies replicas to museography
10.15 – 10.30	**A 77**	Lemaitre, Serge et al.: Interdisciplinary research on Andean mummies at the Royal Museums of Art and History, Brussels, Belgium
10.30 – 11.30		*Brunch*
11.30 – 13.00		**Session 14: Funerary Archaeology & Imaging** **Chair: GYÖRGY PÁLFI**
11.30 – 11.45	**A 78**	Huaman Santillan, Yomira Silvia: The Lord of Cajamarquilla: analysis of the funerary context of the Cajamarquilla mummy from funerary archaeology.
11.45 – 12.00	**A 79**	Van Dalen Luna, Pieter: Archaeological studies on the mummies of the Chancay culture
12.00 – 12.15	**A 80**	Errera, David: Wait in the fire: cremation of mummies as a funeral rite in the pre-Wari period at the archaeological site of Minaspata in the Lucre Basin (Cusco-Peru)
12.15 – 12.30	**A 81**	Timbart, Noelle et al.: A new approach on the smell of Egyptian mummies: study of their odorous organic compounds
12.30 – 12. 45	**A 82**	Kirgis, Pauline et al.: Tiny bugs and mummies: a clever mix! Archaeoentomology, archaeoparasitology and 3D reconstruction
12.45 – 13.00	**A 83**	Krachler, Sophie: Where eternity ends – a conservator‘s job begins
13.00 – 14.00		**Session 15: Mummy Exhibition**
13.00 – 14.00	**A 84**	Picchi, Daniela et al.: The Bologna mummy project: an interdisciplinary approach to the study of human remains from Roman and Medieval Egypt
14.00 – 14.30		**Closing remarks**
15.00 – 17.00		***Mummy labs tour***

Friday, 9 September 2022 – *Excursions:*

Visit to Lazaun Alp + archeoParc	
08:30	Meeting point at Eurac Research
08:40	Meeting point at NOI Techpark
Hike to the Ötzi discovery site	
05:30	Meeting point at Eurac Research
05:40	Meeting point at NOI Techpark

Poster session

SESSION 1:

Iceman

A 01

Medical aspects of Ötzi's arrow wound: how long did he survive the trauma?

Weber, Jochen (Reutlingen, Germany); Wahl, Joachim (Institut für Naturwissenschaftliche Archäologie, Eberhard-Karls-Universität, Tübingen, Germany); Zink, Albert (Institute for Mummy Studies, Eurac Research, Bolzano, Italy);

An arrow injury to the left shoulder is at the centre of the discussion about Ötzi's death.
The investigation is based on a computed tomography and the authors clinical experience of over 20 years in traumatology and vascular neurosurgery. We present wound ballistics of the cutting arrowhead in the body and the medical consequences of this special trauma (penetrating stab injury) which cannot be compared to a gunshot wound.
The extra thoracic wound channel begins left below the spina scapulae and has perforated the infraspinatus and subscapularis muscles (with a hole fracture of the scapulae). The arrowhead came to rest in the area of the axillary neurovascular bundle. The subscapular and axillary hematoma is not space demanding so the scapula is not elevated from the chest wall compared to the contralateral side (blood loss maximum 500 millilitres). The connection between the arrowhead and the shaft is located exactly in the sliding bearing between the shoulder girdle and the chest wall. Here the arrow shaft broke, probably immediately after the injury due to a reflex movement of the shoulder (pain). The extreme left shoulder/arm position was deliberately adopted by Ötzi, because it compresses the wound and death came in this position.
The arrowhead injury resulted in localized bleeding into a not preformed cavity (especially outside the thorax), making a haemorrhagic shock unlikely, even compared to penetrating stab injuries today. We conclude that the trauma was survived for several hours and Ötzi was still able to act during this time.

CORRESPONDENCE TO: **palaeoweber@gmx.de**

A 02

Ötzi: new 3D visualizations of the wound of the left shoulder

Lynnerup, Niels (Department of Forensic Medicine, UCPH, Copenhagen, Denmark); Bøkset, Mari Irgens (Department of Oncology, Odense University Hospital, Odense, Denmark); Villa, Chiara (Department of Forensic Medicine, University of Copenhagen, København Ø, Denmark); Zink, Albert (Institute for Mummy Studies, Eurac Research, Bolzano, Italy);

Investigations of X-ray images and CT scanning series led to conclude that the cause of death of Ötzi, also known as the Iceman, the famous glacier mummy found in the Alps in 1991, was exsanguination due to a puncture wound caused by an arrowhead that lacerated the left subclavian artery.
Using post-processing software, such as Mimics (Materialise), it is possible to analyze in detail the CT images of a mummy and isolate internal structures of the body, including bone, internal organs to single arteries. It is also possible to calculate the volume of the isolated structures. Here, we present the 3D visualizations obtained from the CT scanning of 2013. We have segmented, i.e. isolated, the thorax of Ötzi and, in particular, the different structures in the left shoulder area: bones, arteries, veins, arrowhead and hematoma. We find that the hematoma is more extensive than previously described by Pernten and colleagues (2007). This new part of the hematoma extended frontally, below the subclavian artery, down to the 3rd left rib. The total volume of the entire hematoma is thus 75 cm3, corresponding to 12.5 cl (after correction for dehydration and shrinkage). Finally, we will show 3D reconstructions of the ante-mortem posture of the Iceman to explain the trajectory of the arrow, using 3D models of the body from a recent deceased.

CORRESPONDENCE TO: **chiara.villa@sund.ku.dk**

A 03

Computed tomography as a non invasive tool for long-term control of the preservation of the Iceman

Pernter, Patrizia (Radiology, Bolzano Central Hospital, Bolzano, Italy); Zanotti, Maria Chiara (Radiology, Bolzano Central Hospital, Bolzano, Italy); Tauber, Martina (Department of Pathology, Bolzano Central Hospital, Bolzano, Italy); Peschel, Oliver (LMU Munich, Munich, Germany); Rühli, Frank (Institute of Evolutionary Medicine, Medical Faculty, Zürich, Switzerland); Eppenberger, Patrick (Institute of Evolutionary Medicine, Medical Faculty, Zürich, Switzerland);

The year 2021 marked 30 years since the accidentally discovery of the glacial mummy Ötzi in the South Tyrolean Alps. During these 30 years, in addition to invasive and non-invasive procedures, numerous radiological examinations, including several CT scans, were carried out on the mummy, mainly in search of new findings, made possible by technological advances in the scanner technology.
Since computed tomography is an established, repeatable, non-invasive method in mummy research, in 2021 another CT scan was performed, this time to determine whether macroscopically detectable changes had occurred on the mummy over time. Particular attention was paid to comparing the two most recent CT scans of 2013 and 2021, as both scans were carried out with the same CT equipment and the same scan protocol.
We compared the two scans using density measurements of different tissues, such as bones and soft tissues in selected body regions, as well as morphological comparisons of organ contours and their delineation.
We briefly explain the study planning and execution and present the first results of the comparative analysis.

CORRESPONDENCE TO: **patrizia.pernter@gmail.com**

A 04

High coverage genome of the Tyrolean Iceman reveals high Anatolian Farmer ancestry

Wang, Ke (Department of Archaeogenetics, Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany); Prüfer, Kay (Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany); Krause-Kyora, Ben (Institute of Clinical Molecular Biology, Christian-Albrechts-Universität zu Kiel, Kiel, Germany); Childebaya, Ainash (Department of Archaeogenetics, Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany); Schünemann, Verena (University of Zürich, Zürich, Switzerland); Maixner, Frank (Institute for Mummy Studies, Eurac Research, Bolzano, Italy); Zink, Albert (Institute for Mummy Studies, Eurac Research, Bolzano, Italy); Schiffels, Stefan (Department of Archaeogenetics, Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany); Krause, Johannes (Department of Archaeogenetics, Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany);

The Tyrolean ice mummy named “Iceman”, discovered in the Ötztal Alps in 1991, is known as one of the oldest natural human ice mummies, directly dated to 3484-3104 calibrated BCE. Being one of the first ancient humans whose complete genome had been sequenced, initial genetic analyses of this individual suffered from low genomic coverage and traces of modern-DNA contamination and as a consequence only a limited set of analyses were carried out. To genetically investigate this individual in more detail, we have generated a new complete genome sequence at high genomic coverage (15.3x). We reveal insights into the genetic ancestry of this individual. In particular, we show that, contrary to analyses of the previous genome, no detectable Late Neolithic ‘Steppe ancestry” is present in this individual, and that the Iceman has the highest Anatolian farmer ancestry among contemporaneous ancient European individuals in the fourth millennium BCE, suggesting that he may derive from a rather isolated Alpine population with limited contact to neighbouring hunter gatherers. Phenotypic analysis of the newly generated genome reveals that the Iceman had a higher polygenic score for darker skin than any present-day European populations but lighter skin than early Neolithic farmers and hunter-gatherers from Europe, and that he had risk alleles associated with male-pattern baldness, obesity, Type 2 diabetes and obesity-related metabolism disease. This confirms some of the phenotypic observations from the preserved mummfied body, such as high pigmentation and could explain the absence of hair on his head.

CORRESPONDENCE TO: **ke_wang@eva.mpg.de**

A 05

Reconstructing genomic and social structure of prehistoric individuals from the eastern Italian Alps

Croze, Myriam (Institute for Mummy Studies, Eurac Research, Bolzano, Italy); Paladin, Alice (Institute for Mummy Studies, Eurac Research, Bolzano, Italy); Zingale, Stefania (Institute for Mummy Studies, Eurac Research, Bolzano, Italy); Maixner, Frank (Institute for Mummy Studies, Eurac Research, Bolzano, Italy); Pedrotti, Annaluisa (Department of Humanities, University of Trento,Trento, Italy); Günther, Torsten (Department of Organismal Biology, Evolutionary Biology Centre, Uppsala University, Uppsala, Italy); Zink, Albert (Institute for Mummy Studies, Eurac Research, Bolzano, Italy); Coia, Valentina (Institute for Mummy Studies, Eurac Research, Bolzano, Italy);

The eastern Italian Alps form a natural geographic barrier between Central Europe and the Mediterranean. However, its complex territory, characterized by more isolated mountains areas but also by wide passageways (e.g. Adige valley), have favored populations interaction since prehistory, playing an important role in the genetic and demographic history of Europeans. Despite this, no ancient genetic data are available for this region, except for the Tyrolean Iceman (3360-3100 BC cal.). To fill this gap and reconstruct the genetic structure of ancient alpine groups, we generated paleogenomic data (by shotgun analysis) of 50 prehistoric individuals from 18 archeological sites from the Trentino-Alto Adige region (dated from the Mesolithic to the Late Bronze Age). Comparative analyses to genomic data from other ancient prehistoric individuals from Europe and the Middle East, and present-day populations from the same areas, showed that the alpine Mesolithic individual is similar to hunter-gatherers from Western Europe. On the other hand, the Neolithic and Copper Age individuals, similarly to the Iceman, are genetically close to present-day Sardinians as well as to individuals from Europe and Anatolia dated to the same periods. In contrast, alpine individuals from Bronze Age are more genetically differentiated. On a local scale, our study shows high variation of mitochondrial DNA haplogroups compared to the Y-chromosome. Haplogroups distribution and kinship analyses support close maternal or paternal relatedness among individuals from both sexes and from the same archeological sites, contributing to the understanding of social structure of past alpine groups.

CORRESPONDENCE TO: **valentina.coia@eurac.edu**

SESSION 2:

Biomedicine & Paleoparasitology

A 06

Paleoimaging of Guanche mummies

Rodríguez-Martín, Conrado (Instituto Canario de Bioantropología and Museo Arqueológico de Tenerife (OAMC-Cabildo de Tenerife), Santa Cruz de Tenerife, Spain); Martín-Oval, Mercedes (Instituto Canario de Bioantropología, OAMC-Cabildo de Tenerife, Santa Cruz de Tenerife, Spain); Zander, Tobias (CDyTE, Hospiten, Santa Cruz de Tenerife, Spain); Giovanni, Garcia (CDyTE, Hospiten, Santa CRuz de Tenerife, Spain); Parra, Felipe (CDyTE, Hospiten, Santa CRuz de Tenerife, Spain); Yamileth, Concepcion (CDyTE, Hospiten, Santa Cruz de Tenerife, Spain); Cabrera, Yeray (Fundacion Agora, Las Palmas, Spain); Maynar, Manuel (Catedra de Tecnologias Medicas, ULPGC, Las Palmas, Spain);

A medical imaging study by CT scan was carried out on a selection of 21 Guanche (prehispanic population of Tenerife) mummies (complete and almost complete) and mummified skulls from the collection of Tenerife's Archaeological Museum during 2019 and part of 2020. The specimens come from 16 different burial places distributed by the geography of the island: 12 in the north, 4 in the south, 3 in the west and two from unknown places of Tenerife. The chronology fluctuates between the 4th and the 15th century AD, with most cases (almost 50%) dated between 10th and 13th centuries.
The results of the research will facilitate the paleopathological analysis of bones and soft tissuesd of the prehispanic inhabitants of the island. On the other hand, medical imaging has demonstrated to be an ivaluable tool to check the state of preservation of the samples, the mummification method used by the aboriginals, the presence of posible conserving substances employed during the process and the museological practices used during the second half of the XIXth century and the first years of the XXth to exhibit the bodies.
At the same time, the different attempts to get images by MRI were not satisfactory because the quality of those images were very poor when compared to those of the CT scan due to the lack of water in the samples.

CORRESPONDENCE TO: **crodriguez@museosdetenerife.org**

A 07

Pregnant ancient Egyptian mummy – state of the research and further plans

Ejsmond, Wojciech (Polish Academy of Sciences and Warsaw Mummy Project, Warszawa, Poland); Ozarek-Szilke, Marzena (Department of Oncology Medical University of Warsaw/ Warsaw Mummy Project, Warsaw, Poland); Jaworski, Marcin (Warsaw Mummy Project, Warszawa, Poland); Milani, Chantal (Forensic Anthropologist and Odontologist and Warsaw Mummy Project, Warszawa, Poland); Morrison, Hew (Warsaw Mummy Project); Muñoz Pérez, Carmen (Ecole du Louvre and Warsaw Mummy Project, France); Jaroszewska, Katarzyna (Holy Family Specialist Hospital and Warsaw Mummy Project, Warsaw, Poland); Marshall, Amandine (UMR 8164 Centre National de Recherche Scientifique - Lille 3 and Warsaw Mummy Project, Lille, Monaco);

The goal of the Warsaw Mummy Project is a comprehensive examination of the collection of ancient Egyptian mummies at the National Museum in Warsaw. For this purpose, among others, radiological examinations were carried out.
As part of the project, the mummy from the coffin of the priest Hor-Djehuty (236805/3 MNW), who lived in Thebes at the turn of the eras, was examined. It turned out that the coffin made for the male priest contained the mummy of an unknown woman. Her body has been carefully embalmed and equipped with a rich set of amulets and jewelry. It is tentatively dated to the 1st century BCE, but an age older by a few centuries cannot be excluded.
A fetus in her womb was discovered through CT and X-ray imaging. It died between the 26th and 30th week of gestation. The specific taphonomic processes that have taken place in the womb led to a situation in which the bones of the fetus are barely visible on X-rays and CT images, unlike the preserved soft tissue, which is clearly visible.
The mummy is currently the subject of research by a team that managed to form hypotheses about her health and cause of death and to reconstruct her possible appearance during lifetime. Currently conducted examinations and further research plans will also be presented during the talk.

CORRESPONDENCE TO: **wojtek.ejsmond@wp.pl**

A 08

Evolutionary implications of elongated vascular calcinosis in the mummified forearm of the 4400-year-old probable remains of King Unas

Eppenberger, Patrick (Institute of Evolutionary Medicine, University of Zurich, Zurich, Switzerland); van Schaik, Katherine D. (Harvard Medical School, Initiative for the Science of the Human Past, Harvard University, Boston, U.S.A.); Haidas, Irka (Laboratory for Ion Beam Physics, Swiss Federal Institute of Technology (ETH), Zurich, Switzerland); Ibrahim, Mahmoud (Institute of Evolutionary Medicine, University of Zürich, Zürich, Switzerland); Rühli, Frank (Swiss Mummy Project, Institute of Evolutionary Medicine, University of Zurich, Zurich, Switzerland); Othman, Moamen (Restoration Department, Egyptian Museum in Cairo, Cairo, Egypt);

Radiographic evidence of vascular calcinosis is frequently found in examinations of ancient human mummies from diverse periods, cultures, and geographies. Such findings are often labeled “atherosclerosis” without the provision of detailed differential diagnostic considerations. However, it is essential to understand that atherosclerosis refers to one specific form of many types of vascular calcinosis, all of which are generally subsumed under the umbrella term arteriosclerosis. More precise classification of types of vascular calcinosis is based on localization within the vascular wall and distribution along the vascular tree, including consideration of the size of the involved arteries. Clinically, a distinction is often made between atherosclerosis (also called intimal arteriosclerosis) and medial arterial calcification (also called Mönckeberg’s medial calcific sclerosis). Here, we present the earliest reported radiographic evidence of elongated peripheral vascular calcinosis in an exceptionally ancient human specimen, an over 4400-year-old left forearm fragment attributed to King Unas (5th Dynasty, Old Kingdom). We evaluated the nature of those findings with respect to differential diagnoses and the possible lifestyle, environmental, and hereditary risk factors that would support a diagnosis of either intimal or medial calcinosis. We also reflect on the implications of our findings, namely, whether the entities of vascular sclerosis distinguished in modern clinical practice should be considered, at least in part, as present manifestations of a biologically evolved cline comprising a wide spectrum of medial and intimal forms of vascular calcification.

CORRESPONDENCE TO: **patrick.eppenberger@iem.uzh.ch**

A 09

Microscopic evidence for malaria infection in viscera tissue of the Medici family

Maixner, Frank (Institute for Mummy Studies, Eurac Research, Bolzano, Italy); Boccalini, Giulia (Institute for Mummy Studies, Eurac Research, Bolzano, Italy); Piombino-Mascali, Dario (Department of Anatomy, Histology, and Anthropology, Institute of Biomedical Sciences, Vilnius University, Vilnius, Lithuania); Janko, Marek (Institute of Materials Science, Physics of Surfaces, Technical University of Darmstadt, Darmstadt, Germany); Berens-Riha, Nicole (Department of Clinical Sciences, Institute of Tropical Medicine, Antwerpen, Belgium); Jin Kim, Bum (College of Public Health and Human Sciences, Oregon State University, Corvallis, U.S.A.); Gamble, Michelle (Heritage and Archaeological Research Practice, Edinburgh, United Kingdom); Krause-Kyora, Ben (Institute of Clinical Molecular Biology, Kiel University, Kiel, Germany); Drescher, Dennis (Center of Infectious Diseases, Parasitology, Universitätsklinikum Heidelberg, Heidelberg, Germany); Kilian, Nicole (Center of Infectious Diseases, Parasitology, Universitätsklinikum Heidelberg, Heidelberg, Germany); Stark, Robert (Institute of Materials Science, Physics of Surfaces, Technical University of Darmstadt, Darmstadt, Germany); Joo An, Hyun (Asia-Pacific Glycomics Reference Site, Chungnam National University, Daejeon, Korea (DPR)); Neumann, Jens (Institute of Pathology, Faculty of Medicine, Ludwig Maximilian University, Munich, Germany); Cipollini, Giovanna (Institute for Mummy Studies, Eurac Research, Bolzano, Italy); Grimm, Rudolf (Agilent Technologies, Santa Clara, U.S.A.); Zink, Albert (Institute for Mummy Studies, Eurac Research, Bolzano, Italy);

The Medici were one of the most powerful and influential families in European history. Through their success in commerce and banking, Florence became, from the 14th to the 18th century, the political and intellectual center in the Western world. The remains of family members were buried within the San Lorenzo Basilica in Florence. Before burial, the Medici nobles were subjected to an embalming process that included the removal of the viscera. The internal organs were placed in large terra cotta jars that were entombed along with the coffins of Medici nobles within the San Lorenzo architectural complex.
In this study we subjected viscera tissues from the embalming jars to microscopic and molecular analysis. Initial histological analysis using hematoxylin-eosin staining identified one of the tissues as a possible blood vessel that still contained traces of red blood cells. Further glycan analysis revealed sugars present on the blood cell surface that may indicate the B blood antigen. Unexpectedly, Giemsa staining provided the first indications for a parasite inside the red blood cells. This observation could not be supported by molecular analysis due to the absence of ancient endogenous DNA. However, when we extended our analysis to atomic force microscopy, we detected ring-like structures that resemble developmental stages of Plasmodium spp. or Babesia spp. parasites. Ultimately, immunohistochemistry confirmed the presence of Plasmodium falciparum inside the red blood cells and provided first microscopic evidence for the occurrence of the most fatal form of malaria in the Medici family.

CORRESPONDENCE TO: **frank.maixner@eurac.edu**

A 10

Next Generation sequencing applied to coprolites of Gruta do Gentio II archaeological site, Southeast Brazil

Gurjão, Ludmila (Fundação Oswaldo Cruz, FIOCRUZ BRASIL, Rio de Janeiro, Brazil); Furtado, Carolina (Unidade Genômica, Instituto Nacional do Câncer (INCA), Brasil, Rio de Janeiro, Brazil); Pires, Marcelo (Laboratório de Biologia de Tripanosomatídeos-IOC, Fundação Oswaldo Cruz, FIOCRUZ BRASIL, Rio de Janeiro, Brazil); Darmada, Álvaro (Laboratório de Genômica Funcional e Bioinformática- IOC, Fundação Oswaldo Cruz, FIOCRUZ BRASIL, Rio de Janeiro, Brazil); Neto, Jandira (Instituto de Arqueologia Brasileira (IAB), Brasil, Rio de Janeiro, Brazil); Dias, Ondemar (Instituto de Arqueologia Brasileira (IAB), Brasil, Rio de Janeiro, Brazil); Parente, Thiago (Laboratório de Genômica Funcional e Bioinformática- IOC, Fundação Oswaldo Cruz, FIOCRUZ BRASIL, Rio de Janeiro, Brazil); Mayo Iñiguez, Alena (Laboratório de Biologia de Tripanosomatídeos-IOC, Fundação Oswaldo Cruz, FIOCRUZ BRASIL, Rio de Janeiro, Brazil);

Pre-Columbian archaeological site Gruta do Gentio II (GGII), Southeast Brazil, is characterized by two horizons of subsistence, a hunter-gather (12,000 - 7.295 BP) and a horticulturist (3.490 - 410 BP) population related to the Una ceramist tradition, one of the oldest indigenous traditions of Brazil. Recently, technological innovation approaches such as the Next Generation Sequencing (NGS), have been applied in paleostudies to investigate food habits, parasites, microbiome, and surrounding fauna of ancient populations. For this purpose, in the present study, NGS was used to investigate GGll coprolites. Ancient DNA extracted from coprolites was submitted to multiple PCR markers. Libraries were constructed using amplicons mixes and Illumina MiSeq paired-end sequencing. Previous Sanger analysis of GGII coprolites showed the presence of two vertebrate species, Philander opossum (gray four-eyed opossum) and Leopardus pardalis (ocelot) in the horticulturist horizon, as well as 5 species of zoonotic parasites. The NGS of four coprolites generated 654K reads, which were subjected to BLAST analysis against a customized database. A preliminary analysis showed that 29k reads matched with the 12S rDNA genes in our database, increasing to 11 the number of vertebrate species assigned to GGII, including endemic species of 2 rodents, 5 marsupials, and 2 felids. An extended analysis is likely to further increase the diversity of vertebrates and parasites from GGII, allowing to build a paleoscenario of human and animal coexistence in this pre-Colombian site, where they seem to be share not only space but possibly food sources and parasites.

CORRESPONDENCE TO: **ludmilagurjao@hotmail.com**

A 11

Technological Innovation in Paleoparasitology in Brazil: Preliminary outcomes

Iñiguez, Alena (Fundação Oswaldo Cruz-FIOCRUZ, Rio de Janeiro, Brazil); Pires, Marcelo (Fundação Oswaldo Cruz-FIOCRUZ, Rio de Janeiro, Brazil); Gurjão, Ludmila (Fundação Oswaldo Cruz-FIOCRUZ, Rio de Janeiro, Brazil); Darmada, Alvaro (Fundação Oswaldo Cruz-FIOCRUZ, Rio de Janeiro, Brazil); Brito, Lorrayne (Fundação Oswaldo Cruz-FIOCRUZ, Rio de Janeiro, Brazil); Lopes, Laiz (Laboratório de Biologia de Tripanosomatídeos-IOC/Fundação Oswaldo Cruz, Rio de Janeiro, Brazil); Furtado, Carolina (Instituto Nacional do Cancer-INCA, Rio de Janeiro, Brazil); Parente, Thiago (Fundação Oswaldo Cruz-FIOCRUZ, Rio de Janeiro, Brazil); Borba, Victor Hugo (Fundação Oswaldo Cruz-FIOCRUZ, Rio de Janeiro, Brazil);

Paleoparasitology, the study of parasites found in archaeological materials, is a term coined and established in Brazil that has changed previously held beliefs about the origins of infectious diseases in the New World. The detection of ancient DNA from the parasite Trypanosoma cruzi in Brazilian hunter-gatherers indicated that Chagas disease was present in the country in pre-Columbian times. However, paleoparasitological research in Brazil is challenged by the imperative taphonomic damage of biological remains, especially in pre-Columbian archaeological sites.
We have been working on the application of technological innovations in paleoparasitology by using ecological niche modeling (ENM), artificial intelligence (AI), and next generation sequencing (NGS) methodologies. ENM is being used to propose scenarios of paleodistribution of parasitic diseases, primarily Chagas disease in South America during the Holocene period. An approach to the taxonomic identification of parasite species based on the helminth eggs database and machine learning/AI method was implemented and is currently being evaluated in ancient helminth eggs. Finally, NGS-based paleogenomics elucidates questions about parasites, hosts, and the environment from Pre-Columbian archaeological remains. We will present the preliminary outcomes of integrating technological innovations in paleoparasitology which improves our comprehension of the diverse paleoepidemiological scenarios of the human evolutionary history in the New World.

CORRESPONDENCE TO: **alenainiguez@gmail.com**

SESSION 3:

South American mummies – Imaging and Bioarchaeology

A 12

ONE Paleopathology: Globalizing the Study of Ancient Health

Buikstra, Jane (Center for Bioarchaeological Research,Arizona State University, Tempe, AZ, U.S.A.);

This presentation introduces ONE Paleopathology, a wholistic paleopathology that develops from the biomedical ONE Medicine/ONE Health initiatives. ONE Paleopathology, like its biomedical analogues, extends a core veterinary science/animal paleopathology to the creation of encompassing and evolving global health perspectives. Engaging all aspects of health, including animals and their environments, ONE Paleopathology facilitates addressing worldwide issues of significance, past and present. Biomedical advances in imaging and genomics thus mesh naturally with traditional observations of contexts and morphological observations of remains. We initially review the histories of ONE Medicine, ONE Health, and Paleopathology as these topics anchor ONE Paleopathology.
Recent advances in imaging, genetic/molecular analyses and computer modeling encourage investigations of disease, past or present, to extend beyond morphological assessments. However, to take full advantage of the remarkable new opportunities, an integrated, problem-oriented approach is required. The identification of significant questions should receive primary emphasis, rather than methodologies. As illustrated by its application to Burkholderia spp, morbilliviruses, Mycobacterium spp., and metabolic bone diseases, a One Paleopathology approach uses an evolutionary context to integrate the perspectives provided by multidisciplinary knowledge bases. It thus provides the global and technologically sophisticated viewpoint required to truly understand the complex histories of diseases and can inform both future research and clinical applications.

CORRESPONDENCE TO: **buikstra@asu.edu**

A 13

The Bolivian Mummy Project – Different lines of scientific evidence for the study of pre-Columbian mummies at Museums

Valverde, Guido (Institute for Mummy Studies, Eurac Research, Bolzano, Italy); Niederkofler, Jasmin (Institute for Mummy Studies, Eurac Research, Bolzano, Italy); Paladin, Alice (Institute for Mummy Studies, Eurac Research, Bolzano, Italy); Samadelli, Marco (Institute for Mummy Studies, Eurac Research, Bolzano, Italy); Castedo, Luis (Museo Nacional de Arqueología – MUNARQ, Ministerio de Culturas, La Paz, Bolivia); Maixner, Frank (Institute for Mummy Studies, Eurac Research, BZ, Italy); Zink, Albert (Institute for Mummy Studies, Eurac Research, Bolzano, Italy);

The Bolivian Mummy project represents the first systematic bioarchaeological study of mummified human remains from Bolivia. This interdisciplinary project combines the anthropological, archaeological, historical, and genetic analysis of the mummy collection housed at the National Museum of Archaeology - MUNARQ in La Paz, in order to provide the scientifically best possible historical overview on these precious pre-Columbian remains. We aim to combine our expertise in a unique platform to address fundamental questions regarding the history and future preservation of this cultural heritage.
Exploring the mummies with our holistic approach (CT scanning, ancient DNA, metagenomics, and conservation) will provide precious information on their history helping to reflect the lifestyles of ancient and modern communities. Importantly, this project tries to implement the appropriate ethical guidelines for studying ancient human remains in Bolivia to preserve this material for future generations. Finally, with the results achieved in this project this cultural heritage will receive the public interest it deserves, and it will become an important part of the Bolivian history.

CORRESPONDENCE TO: **guido.valverde@eurac.edu**

A 14

Llullaillaco child mummies: bioarcheology context – part 1

Wilson, Andrew (School of Archaeological & Forensic Sciences, Faculty of Life Sciences, University of Bradford, Bradford, United Kingdom); Villa, Chiara (Department of Forensic Medicine, University of Copenhagen, Copenhagen, Denmark); Sparrow, Tom (School of Archaeological & Forensic Sciences, University of Bradford, Bradford, United Kingdom); Telford, Richard (University Analytical Centre, University of Bradford, Bradford, United Kingdom); Bernaski, Mario (Museo de Arqueología de Alta Montaña, Salta, Argentina; Recagno, Gabriela (Museo de Arqueología de Alta Montaña, Salta, Argentina); Reinhard, Johan (National Geographic Society Explorer, USA, Washington DC, U.S.A.); Ceruti, Constanza (Catholic University of Salta, Salta, Argentina); Lynnerup, Niels (Department of Forensic Medicine, University of Copenhagen, Copenhagen, Denmark); Taylor, Tim (Department of Archaeology, Comenius University in Bratislava, Bratislava, Slovakia);

The Capacocha was an important sacrificial ceremony in the Inca Empire and involved the sacrifice of children. The frozen bodies of three children, ritually killed as part of the capacocha rite, were discovered close to the summit of Volcán Llullaillaco, one of South America's highest mountains (6739m) in 1999. Given their exceptional state of preservation, these children represent unique opportunities to shed light on health conditions, disease and rites of the Inca culture. We will present the results of biochemical analyses that helped us to deepen our understanding of the circumstances and context of final placement on the mountain top. We will also discuss the challenges and sensitivities of working with such a unique assemblage; the importance of the children for the indigenous community and how the community are involved in the ongoing study and curation of these children. These children are very recognisable as individuals and as such have powerful emotional impact for many today. The Revisiting the Capacocha' project aims to elucidate some of the practices associated with the complex rite "Capacocha", combining forensic techniques with archaeological knowledge. It is an international project led by the University of Bradford (UK) in collaboration with researchers from the several European universities and South America Museums.

CORRESPONDENCE TO: **A.S.Wilson2@bradford.ac.uk**

A 15

Llullaillaco child mummies: 3D documentation and imaging analysis – part 2

Villa, Chiara (Department of Forensic Medicine, University of Copenhagen, København Ø, Denmark); Sparrow, Thomas (School of Archaeological & Forensic Sciences, Faculty of Life Sciences, University of Bradford, Bradford, United Kingdom); Telford, Richard (School of Chemistry and Bioscience, Faculty of Life Sciences, University of Bradford, Bradford, United Kingdom); Bernaski, Mario (Museo de Arqueología de Alta Montaña, Salta, Argentina); Recagno, Gabriela (Museo de Arqueología de Alta Montaña, Salta, Argentina); Ceruti, Constanza (Inca Archaeology at the Catholic University of Salta (UCASAL), Salta, Argentina); Taylor, Tim (Department of Archeology, Comenius University, Bratislava, Slovakia); Lynnerup, Niels (Department of Forensic Medicine, University of Copenhagen, Copenhagen, Denmark); Wilson, Andrew (School of Archaeological & Forensic Sciences, Faculty of Life Sciences, University of Bradford, Bradford, United Kingdom);

Mummies are silent witnesses to ancient cultures and represent unique opportunities to shed light on health conditions, disease and cultural rites. As such, they should be preserved and accurately documented with imaging techniques such as Computed Tomography (CT) scanning and photogrammetry. CT scanning is a non-invasive and non-destructive technique routinely used in mummy studies and enables a 3D documentation of internal and external aspects of the body. However, the texture (e.g. colour information) is not acquired and the resolution of the CT is not adequate for recording fine skin details (e.g. tattoos, superficial lesions). Such information can acquired using photogrammetry, a technique that enables to generate high-resolution 3D coloured model of the external aspect of an object by means of 2D photographs.
Here, we present the results of imaging techniques on the Llullaillaco child mummies. The three 500-years-old mummies belonging to sacrificial Inca children were discovered on the top of the Llullaillaco volcano, one of South America's highest mountains (6739m) on March 1999. They are frozen mummies and kept at a constant temperature of -20º Celsius. Any analysis on the mummies can be performed during a windows time of 10 minutes. We will present some of the difficulties on working with such type of mummies. Finally, in this context we will discuss the importance of using complementary non-destructive of 3D imaging techniques and their potential use for conservation purposes as well as interpretation – delivering new understanding and meaningful experience to the indigenous community and wider public.

CORRESPONDENCE TO: **chiara.villa@sund.ku.dk**

A 16

Mummies as Microcosms: Analysis of Mummy Bundles from the Central Coast of Peru (1100 AD-1532 AD) using Computed Tomography

Watson, Lucia (Dirección de Humanidades Artes y Ciencias Sociales (HAS), Universidad de Ingeniería y Tecnología, Lima, Peru); Fuentes, Sarita (Museo Pachacamac, Ministerio de Cultura del Peru, Lima, Peru); Nelson, Andrew (Department of Anthropology, The University of Western Ontario, London, Canada); Williams, Jocelyn (Department of Anthropology, Trent University, Peterborough, Canada); Gauld, Suellen (Department of Anthropology, Santa Monica College, California, U.S.A.); Motely, Joanna (Department of Anthropology, The University of Western Ontario, London, Canada); Poeta, Lauren (Department of Anthropology, The University of Western Ontario, London, Canada); Alvares, Alcides (Department of Social Science, Universidad Nacional Mayor de San Marcos, Lima, Peru); Cordova, Maria Fe (Department of Letters and Humanities, Pontificia Univerisdad Católica del Peru, Lima, Peru); Baldeos, Jhon (Deparment of Social Science, Universidad Nacional de Trujillo, Lima, Peru); Pozzi-Escot, Denise (Museo Pachacamac, Ministerio de Cultura del Perú, LIMA, Peru);

This project aims to study funerary bundles (fardos) from the Central Coast of Peru between 1100d.C-1532d.C using non-destructive, non-invasive methods. The funerary bundle is an integral unit of analysis that allows us to address biological and sociopolitical aspects of the communities of the past. The methodology proposed by Nelson (et al. 2021) was followed, which is based on a selective process of different stages: direct observations>x-rays>CT-Scans. The sample consists of 73 bundles, coming from: Pachacamac, Ancón and Huaycan de Pariachi. We studied process of building the fardo and its associations. The research question was: can one speak of a funerary treatment shared by the entire population of the central coast in the same period?, or would each site present its own peculiarities? The funerary behaviors of two pre-Hispanic coastal groups were characterized: Chancay and Ychma. The overall construction of the bundle indicated a generalized mortuary treatment for the population regardless of age, sex or status. However, each fardo has its own peculiarities that include artifacts within the fardo and its exterior finishes. The shared elements include: these bundles are the result of a single, albeit extended, moment of preparation of the fardo, and the adult individuals are in a seated/flexed position, while the youngest non-adults are in an extended position. The use of simple textiles with little decoration, ropes on the outside, fillings of organic material and offerings that were not made expressly for the deceased allow us to delve into the materialization of individual identities from the past.

CORRESPONDENCE TO: **luciawatson111@gmail.com**

A 17

The city of the Living and the Dead: Bioarchaeology and our understanding of the site of Pachacamac, Peru - 120 years of history

Fuentes, Sarita (Museo Pachacamac, Ministerio de Cultura del Perú, Lima, Peru); Pozzi-Escot, Denise (Museo Pachacamac, Ministerio de Cultura del Perú, Lima, Peru); Watson, Lucía (Dirección de Humanidades Artes y Ciencias Sociales, Universidad de Ingeniería y Tecnología (UTEC), Lima, Peru); Nelson, Andrew (Department of Anthropology, Western Ontario University, Ontario, Canada);

This work represents an initial general overview of the different publications and reports carried out on the mortuary contexts and bioarchaeological analyses from the site of Pachacamac, Peru. The first such publication was made by Max Uhle in 1903, in which he reported the presence of 80,000 mummies and human burials. The current Mummies as Microcosms Project carries on this work, using non-destructive imaging and digital technology.
The Pachacamac sanctuary, was continuously occupied from 200AD to 1533AD. It is located on the coast of the Pacific Ocean just south of Lima, and it has an area of 465ha., including major ceremonial structures such as the so-called Old Temple, Painted Temple, and Temple of the Sun. This monumental site has been a focus of interest for different researchers throughout our history, because Pachacamac was one of the main oracles of ancient Peru; its power was expressed in the summons to pilgrims, who came to this sacred space to make their supplications.
The bioarchaeological analyses of these individuals, compared with the architectural context of the burials, have allowed us to have a real understanding of the social dynamics that took place in the oracle throughout its long occupation. In short, the central objective of this research is, from a bio-archaeological perspective, to advance the understanding of the site based on the results of the analysis of human skeletal and mummified remains.

CORRESPONDENCE TO: **fuentesarita@gmail.com**

A 18

The toxicological analysis of Nazca mummies

Socha, Dagmara (Center for Andean Studies, University of Warsaw, Warsaw, Poland); Sykutera, Marzena (Nicolaus Copernicus University, Poland);

The use of hallucinogenic plants and stimulants was widespread in the ancient Andes. They performed an important role in the beliefs, rituals, and divination practices. The preservation of naturally mummified bodies in Nazca drainage, provided an opportunity to for the first time analyze which psychoactive plants were used on the southern Peruvian coast. The hair and skin samples of 22 individuals were examined using LC-MS/MS for the presence of coca alkaloids and metabolites (cocaine, benzoylecgonine, cocaethylene), mescaline, tryptamine, harmaline, and harmine.
The results of the study show that during Nazca times (100 BCE - 750 CE) only selected individuals had access to the limited amount of coca leaves. The Nazca inhabitants also consume the vine of Banisteriopsis caapi, a source of harmine, main compound of the hallucinogenic ayahuasca beverage, and hallucinogenic San Pedro cactus. These are the oldest archaeological evidence of the consumption of these plants.

CORRESPONDENCE TO: **d.socha@uw.edu.pl**

SESSION 4:

Atherosclerosis & Imaging

A 19

Atherosclerosis in Ancient Mummies: The HORUS Study of 268 Adult Individuals

Thompson, Randall (Cardiology, St. Luke's Mid America Heart Institute, Kansas City, U.S.A.); Allam, Adel (Department of Cardiology, Al Azhar University, Cairo, Egypt); Wann, L. Samuel (University of New Mexico, Albuquerque, U.S.A.); Sutherland, M Linda (MemorialCare Heart & Vascular Institute, MemorialCare, Fountain Valley, CA, U.S.A.); Sutherland, James D (MemorialCare Heart & Vascular Institute, MemorialCare, Fountain Valley, CA, U.S.A.); Frohlich, Bruno (Smithsonian Institution, Washington, DC, U.S.A.); Miyamoto, Michael (Division of Cardiology, Mission Heritage Medical Group, Providence Health, Los Angeles, CA, U.S.A.); Rowan, Chris (Renown Institute for Heart and Vascular Health, Reno, Nevada, U.S.A.); Michalik, David (Miller Children's and Women's Hospital, University of California, Irvine, Long Beach, CA, U.S.A.); Finch, Caleb (Ethel Percy Andrus Gerontology Center, University of Southern California, Los Angeles, CA, U.S.A.); Zink, Albert (Institute for Mummy Studies, Eurac Research, Bolzano, Italy); Lombardi, Guido (Laboratorio de Paleopatologia, Catedra Pedro Weiss, Universidad Peruana Cayetano Heredia, Lima, Peru); Thomas, Gregory (MemorialCare Heart & Vascular Institute, MemorialCare, University of California, Irvine, Fountain Valley, CA, U.S.A.);

Atherosclerosis is usually thought of as a disease plaguing people living modern lifestyles during more recent times, yet it has been shown to also be present in ancient people. The HORUS Study has reviewed numerous CT scans of mummified individuals from 5 ancient cultures systematically searching for the presence of atherosclerosis.
Results: 268 whole body CT scans of adult mummies with differing levels of preservation were reviewed. All had at some soft tissue present. Mummies lived between 3000 BCE and 1850 CE, and were from Egypt, Peru, Mongolia, and two sites in North America. Average age at the time of death was about 40 years. A total of 76 (28.4%), had either calcifications within the wall of an identifiable artery (definite atherosclerosis) or along the expected course of an artery (probable atherosclerosis). The appearances of the atherosclerotic arterial calcifications were identical to those seen in modern patients and were seen in every vascular bed, every ancient culture, and every epoch of time. Numerous individuals had heavy calcification in multiple arterial beds, suggesting that they likely suffered from clinical disease rather than incidental arterial changes.
Conclusion: While atherosclerosis is often viewed as a disease of modern times, these data indicate that it has been significantly present for much of human history.

CORRESPONDENCE TO: **heartrct@gmail.com**

A 20

Cardiovascular disease in Nile valley mummies: exploring the need for a more systematic approach that accounts for vessel prevalence and the impact of Dual Energy CT scanning

Antoine, Daniel (Department of Egypt and Sudan, The British Museum, London, United Kingdom);
Vandenbeusch, Marie (Department of Egypt and Sudan, The British Museum, London, United Kingdom);
Whiting, Rebecca (Department of Egypt and Sudan, The British Museum, London, United Kingdom);

Nine Egyptian and Sudanese mummies were recently CT scanned (or in some cases rescanned). Ranging in date from 3500 BC to AD 700, seven out of these nine mummies were artificially embalmed and two were naturally mummified by the hot and arid desert conditions of the Nile valley. The latest generation of CT scanners, a Dual Energy CT, was used to analyse their remains without unwrapping them. The arteries of the seven adult mummies were explored for signs of CVD (cardiovascular disease) and, when possible, detailed three-dimensional visualisations of the pubic symphysis were generated to estimate their age at death. Some mummies had featured in earlier studies, offering an opportunity to investigate if the use of a newer style of CT scanner improves the detection of atheromas in mummified remains. High density deposits identified as atheromas were found in three of the five artificially mummified adult bodies. Based on these findings, the impact of Dual Energy CT on the visualisation of atheromas and the benefits of a more systematic approach that accounts for all preserved and/or detectable arteries (whether or not affected by atherosclerosis) are discussed. It is hoped that this will allow for a clearer assessment of the past prevalence of CVD that accounts for varying preservation, and differences in embalming and analytical methods.

CORRESPONDENCE TO: **antoine.daniel@gmail.com**

A 21

Atherosclerotic cardiovascular disease in mummies – A polygenic risk score based on a genetic enrichment approach

Wurst, Christina (Institute for Mummy Studies, Eurac Research, Bolzano, Italy); Co-Author: Maixner, Frank (Institute for Mummy Studies, Eurac Research, Bolzano, Italy); Valverde, Guido (Institute for Mummy Studies, Eurac Research, Bolzano, Italy); Teßmann, Barbara (Berlin Society of Anthropology, Ethnology and Prehistory, Berlin, Germany); Krause-Kyora, Ben (Institute of Clinical Molecular Biology, Christian-Albrechts-Universität zu Kiel, Kiel, Germany); Krause, Johannes (Department of Archaeogenetics, Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany); Del Vesco, Paolo (Museo Egizio, Fondazione Museo delle Antichità Egizie di Torino, Turin, Italy); Helmbold-Doyé, Jana (Ägyptisches Museum und Papyrussammlung, Staatliche Museen zu Berlin, Berlin, Germany); Hotz, Gerhard (Natural History Museum Basel, Basel, Switzerland); Thompson, Randall (Saint Luke's Mid America Heart Institute, University of Missouri Kansas City, Kansas City, U.S.A.); Zink, Albert (Institute for Mummy Studies, Eurac Research, Bolzano, Italy);

Atherosclerotic cardiovascular disease (ASCVD) results in heart attack, stroke, and peripheral vascular disease and thus is one of the main causes of death in developed countries. Until the beginning of this century it has been widely assumed that ASCVD is a modern disease of affluence connected to an unhealthy lifestyle. Current studies, however, display growing evidence for the presence of atherosclerosis in ancient human remains. In addition, in modern medicine genetic predispositions gain an increasingly importance in the understanding of the development of ASCVD. However, genetic data about the prevalence of the disease associated single nucleotide polymorphisms (SNPs) in our ancestors is almost lacking.
Here, we present for the first time, a polygenic risk score (PRS) for ASVCD in human remains based on 87 SNPs in 56 genes that were associated to ASCVD in genome-wide association studies. We analysed ancient human genomes from various geographic origins and time periods, including mummies from South America, Australia, Egypt, and Europe. Next-generation sequencing methods, including a novel enrichment approach designed specifically to capture ASCVD associated SNPs, have been applied. Genetic results were compared to the physical occurrence or absence of atherosclerotic plaques visible on computed tomography scans of the analysed individual.Our study provides more insights into the presence and possible changes of genetic risk factors in our ancestors. Comparing the PRS to the different lifestyles of the past could lead to a better understanding of the interaction between environmental and genetic influences on the development of ASCVD.

CORRESPONDENCE TO: **Christina.Wurst@eurac.edu**

A 22

Atherosclerosis in Arctic Mummies Despite Consumption of a Marine Based Diet High in Omega-3 Fatty Acids

Wann, Lee (Division of Cardiology, University of New Mexico School of Medicine, Santa Fe, U.S.A.); Frohlich, Bruno (Smithsonian Institution, Washington, DC, U.S.A.); Thompson, Randall C (University of Missouri–Kansas City School of Medicine, Kansas City, MO, U.S.A.); Allam, Adel H (Department of Cardiology, Al Azhar University, Cairo, Italy); Sutherland, M. Linda (MemorialCare Heart & Vascular Institute, MemorialCare, Fountain Valley, CA, U.S.A.); Sutherland, James D (MemorialCare Heart & Vascular Institute, MemorialCare, Fountain Valley, CA, U.S.A.); Miyamoto, Michael I (Division of Cardiology, Mission Heritage Medical Group, Providence Health, Mission Viejo CA, U.S.A.); Rowan, Christopher J (Renown Institute for Heart and Vascular Health, Reno, Nevada, U.S.A.); Michalik, David E (Miller Children's and Women's Hospital, University of California, Irvine, Long Beach CA, U.S.A.); Lombardi, Guido P (Laboratorio de Paleopatologia, Catedra Pedro Weiss, Universidad Peruana Cayetano Heredia, Lima, Peru); Finch, Caleb E (Ethel Percy Andrus Gerontology Center, Leonard Davis School of Gerontology, University of Southern California, Los Angeles, CA, U.S.A.); Thomas, Gregory S (MemorialCare Heart & Vascular Institute, MemorialCare, University of California, Irvine, Fountain Valley, CA, U.S.A.);

There is substantial interest in diets that could be protective against atherosclerosis, including those consumed by ancient cultures. Studying Greenlandic Inuits, Dyerberg et al (Lancet 1978;312:117.) and others proposed that a marine based diet high in omega-3 fatty acids could have a protective impact.
Results: To evaluate this hypothesis, four adult mummies retrieved from Uunartaq Island in Southern Greenland who lived c. 1500's underwent whole body CT scanning at the Brigham and Women's Hospital, Boston, Massachusetts. In addition, whole body CT scans of four adult Aleutian Islander mummies who lived c. 1756 to 1930 imaged at the Smithsonian Institution were provided for formal review. Both were fisherman-hunter-gatherer cultures without agriculture or domesticated animals, each consuming a marine based diet high in omega-3 fatty acids. Definite atherosclerosis was present in three of the four Aleutian Islanders and two of the four Greenlandic mummies. Probable atherosclerosis was identified in an additional Greenlandic mummy. A literature review was performed of ancient arctic mummies from present day Alaska, Canada, and Greenland that underwent either autopsy or imaging. Atherosclerosis was demonstrated by autopsy in five ancient mummies from present day Alaska and by X-Ray imaging of four ancient Greenlandic mummies.
Conclusion: While a protective effect of a diet high in omega-3 fatty acids cannot be ruled out, atherosclerosis has been demonstrated in fifteen mummies living in regions in which such a marine based diet high in omega-3 fatty acids was consumed.

CORRESPONDENCE TO: **gthomas9@mac.com**

A 23

New reading in ancient mummification technique by using CT scan as non destructive tool for mummies examination applied onTjanefer mummy (H-3rd intermediate, Dynasty 21)

Badr, Ibrahem (MUST University, Giza, Egypt)

Using advanced modern technology is considered one of the most important methods of scientific examination and registration. This should be used in the field of the conservation of mummies. Identifying the case of the mummy and putting the mummy outwardly or inwardly are the first stage of good prognosis of damage, which naturally lead to the development of an appropriate plan for the operations of treatment and conservation starting from the stage of cleaning until museum presentation, through a consistent process with the requirements of preventive conservation.
The Study of Ancient Egypt, and particularly the examination of mummies, is subjects of interest of scientist and the public. It is fortunate that modern diagnostic methods of the study of ancient human beings can be applied today.
CT studies confirm that the ancient Egyptian has used methods to support the body and maintain the external shape of the mummy. Research also stresses on the need for a new reading of the science of mummification according to the latest scientific methods of examination without any destructive activities toward the components of the various mummies. The main aim of this research is to study thoroughly the Third Intermediate Period mummies to show the level of sophistication of the technique of the mummification reached in this period.
Keywords: Mummy, Mummification, CT Scanning, TJANEFER, 3rd Intermediate.

CORRESPONDENCE TO: **ibrahembadr77@gmail.com**

A 24

Metal offerings and the mummy: The analysis of the contents of funerary bundles from the Central Coast of Peru (1100d.C-1532d.C) based on CT-Scans

Vetter, Luisa (Department of Letters and Humanities, Pontificia Universidad Católica del Peru, Lima, Peru); Watson, Lucia (Dirección de Humanidades Artes y Ciencias Sociales, Universidad de Ingeniería y tecnología (UTEC), Lima, Peru); Motley, Joanna (Department of Anthropology, Western Ontario University, London, Canada); Nelson, Andrew (Department of Anthropology, Western Ontario University, London, Canada);

This work presents a method to study metals included within mummy bundles (fardos) in a non-invasive, non-destructive way using CT-Scans. A total of 26 fardos were observed which contained at least one metal object. These bundles come from the central coast of Peru (Ancón, Puruchuco and Huaycan de Pariachi) and date between 1100AD and 1532AD.
The individuals were analyzed using a skeletal taphonomic approach to reconstruct patterns decomposition. This allowed us to reconstruct the original position of the body and what must have been the location of the metals in relation to the deceased. The metal objects have been registered identifying their use, decoration, measurements, location within the bundle and relationship with other objects associated with the individual.
The metals were associated with bundles of female, male and non-adult individuals. The following objects were identified: bracelets, earspools, fragments, tupus, tweezers, headbands, lime spatulas, among others. In some cases, consistent relationships could be determined in terms of the type of associated objects (tongs and lime spatula). It was possible to demostrate the presence of metal elements in bundles without any other type of associated offerings. There was no consistent association between sex or age of the individuals who carry metal objects, which could suggest the need to consider metals as an indicator of social status, in these pre-Hispanic societies. It was not possible to determine a general and absolute rule on the relationship between body position and metal objects that made up the offerings or wrappings of the deceased.

CORRESPONDENCE TO: **luciawatson111@gmail.com**

SESSION 5:

Molecular analysis & Imaging

A 25

Synergistic paleopathological analysis of Chachapoya mummified remains, northeastern Peru

Nelson, Elizabeth (Microbial Paleogenomics Unit, Institut Pasteur, Azle, U.S.A.); Toyne, J. Marla (Department of Anthropology, University of Central Florida, U.S.A.); Guevara, Evelyn (Department of Archaeogenetics, Max Planck Institute for the Science of Human History, Germany); Herbig, Alexander (Department of Archaeogenetics, Max Planck Institute for the Science of Human History, Germany); Krause, Johannes (Department of Archaeogenetics, Max Planck Institute for the Science of Human History, Germany); Bos, Kirsten (Department of Archaeogenetics, Max Planck Institute for the Science of Human History, Germany);

Molecular paleopathology has the potential to provide additional details about infectious disease when morphological analysis is ambiguous by permitting the identification and genomic characterization of ancient pathogens. Investigations of tuberculosis (TB) in pre-Hispanic South America have provided relevant examples of these phenomena and revealed unexpected disease/pathogen histories. Here, we present one such case from the Chachapoya funerary site of Diablo Huasi, located in the north-eastern Andean slopes. This partially mummified adult individual displayed extreme kyphosis with diffuse focal lesions across the mid to lower thoracic vertebrae that are unsual in both morphology and distribution. We employed multiple methods of analysis to investigate the manifestation of pathology in this individual. Results of morphological and radiographic analysis reveal the appearance and distribution of the observed pathological changes are consistent with vertebral hemangioma (benign vascular tumor), not TB. However, metagenomic broad pathogen screening of three anatomical elements of the individual resulted in the detection of Mycobacterium tuberculosis complex (MTBC) DNA, known to cause TB. The recovery and reconstruction of a 15-fold MTBC genome permitted phylogenetic analysis revealing the strain to be closely related to those from ancient Peruvian coastal and highland populations, providing insight into the local ecology and evolution of pre-Hispanic TB. These results emphasize the importance of synergistic approaches to paleopathology involving morphological and molecular methods and demonstrate the potential of molecular methods to identify possible hidden co-morbidities. With these results, we can better explore co-existing disease conditions and their impact on the lived experience, frailty, and mortality of the past.

CORRESPONDENCE TO: **mselizabethn903@gmail.com**

A 26

Reconstructing the ancient *Helicobacter pylori* genome of an 18th century mummy from Basel, Switzerland

Granehäll, Lena (Institute for Mummy Studies, Eurac Research, Bolzano, Italy); Sarhan, Mohamed Sabry (Institute for Mummy Studies, Eurac Research, Bolzano, Italy); Thorell, Kaisa (Department of Clinical Microbiology, Sahlgrenska University Hospital, Gothenburg, Sweden); Linz, Bodo (Department of Biology, Division of Microbiology, Friedrich Alexander Universität Erlangen-Nürnberg, Erlangen-Nürnberg, Germany); Moodley, Yoshan (Department of Zoology, University of Venda, Thohoyandou, South Africa); Engstrand, Lars (Department of Microbiology, Tumor and Cell Biology, Karolinska Institutet, Stockholm, Sweden); Hotz, Gerhard (Natural History Museum Basel, Basel, Switzerland); Zink, Albert (Institute for Mummy Studies, Eurac Research, Bolzano, Italy); Maixner, Frank (Institute for Mummy Studies, Eurac Research, Bolzano, Italy);

The stomach bacterium *Helicobacter pylori* has a long and intimate association with humans, possibly since the dawn of humanity. It causes a variety of upper gastrointestinal disorders, including chronic gastritis, peptic ulcer disease and gastric cancer. It is ubiquitously present and infects almost 50% of humans worldwide. Its high prevalence and mode of transmission within families or close bio-geographic populations, along with its high genetic variability make it a useful marker for tracing human migration. New generation sequencing technology has been successfully applied to retrieve ancient *H. pylori* DNA from intestinal soft tissues and gut content of a few mummies across the world, including the Tyrolean glacial mummy known as "Ötzi", whose 5,300-year-old *H. pylori* genome represents the only so far reconstructed ancient *H. pylori* genome.
In this study, we reconstructed the genome of an ancient *H. pylori* strain from the mummified human remains of Anna Catharina Bischoff, an upper-class member of post-reformed Basel. By using an enrichment capture approach designed to target *H. pylori* DNA, we obtained an average 47x coverage across the 18th century genome. Further investigations aim to create a de novo assembly of the genome to increase its completeness as well as study possible recombination events and genomic rearrangement which is not discernible with alignment based methods alone. By comparing the ancient *H. pylori* genome with the vast amount of available modern European *H. pylori* genomes, we aim to shed new light on the diversity of *H. pylori* in 18th century Europe.

CORRESPONDENCE TO: **lena.granehall@gmail.com**

A 27

Multiomic applications in the study of biomolecular preservation and ancient disease discovery

Boggi, Byron (Faculty of Biology, Medicine and Health, Division of Cell Matrix Biology and Regenerative Medicine, University of Manchester, Manchester, United Kingdom); Sharpen, Jack (Faculty of Biology, Medicine and Health, Division of Cell Matrix Biology and Regenerative Medicine, University of Manchester, Manchester, United Kingdom); Taylor, George (BioMS Core Facility, Faculty of Biology, Medicine and Health, University of Manchester, Manchester, United Kingdom); Drosou, Konstantina (Faculty of Biology, Medicine and Health, Division of Cell Matrix Biology and Regenerative Medicine, University of Manchester, Manchester, United Kingdom);

Multiomics is a fast emerging approach whereby various omic methods are analysed and studied in parallel to provide a holistic view into biological systems in modern as well as ancient studies. However, biomolecular studies of ancient organisms have largely focused on dedicated studies of either ancient DNA (aDNA) or proteomics in skeletal remains from temperate environments, which poses limitations in data integration and interpretation.
Analysing major classes of biomolecules together (proteins, lipids, metabolites) enables more detailed insights into health and disease, via the inference of phenotype, to complement genotype, host-pathogen interactions, and altered metabolism. Furthermore, a multi-omic approach maximises recovery of biomolecules from a single template, offering a more ethical approach to destructive sampling of finite material.
We devised a novel, integrated protocol for the simultaneous extraction of DNA, protein, lipids and metabolites from a single template and validated it on artificially mummified porcine soft tissue. Initial comparisons of our protocol with standalone protocols showed comparable recovery of protein, lipids and metabolites and increased recovery of DNA. We then examined biomolecular preservation in spontaneously mummified soft tissues from the two ancient Nubian cemeteries of Kulubnarti (Early Christian Period, ~550–800 CE). Mass spectrometric-based results (LC MS/MS) show comparable recovery of the respective classes of biomolecules, including myelin related lipids and proteins, when comparing our protocol to that of dedicated standalone protocols. Preliminary results via flurometric quantification are very promising and show good recovery of DNA with our protocol, which exceeds the dedicated standalone protocol, whilst shotgun genomic sequencing is underway.

CORRESPONDENCE TO: **byron.boggi@manchester.ac.uk**

A 28

Proteomic profiling of tissues from a medieval Mongolian mummy

Lerchi, Andrina (Institute of Evolutionary Medicine / Swiss Mummy Project, University of Zurich, Zurich, Switzerland); Pedergnana, Antonella (Institute of Evolutionary Medicine / Swiss Mummy Project, University of Zurich, Zurich, Switzerland); Myagmar, Erdene (Department of Anthropology and Archaeology, National University of Mongolia, Ulan Bator, Mongolia); Myagmarsuren, Butemj (Mongolian Centre of Cultural Heritage, Ullan Bator, Mongolia); Eppenberger, Patrick (Institute of Evolutionary Medicine / Swiss Mummy Project, University of Zurich, Zurich, Switzerland); Wilkin, Shevan (Institute of Evolutionary Medicine / Swiss Mummy Project, University of Zurich, Zurich, Switzerland);

The condition of mummified individuals may range from very well to very poorly preserved depending on burial context and environment. Poor physical preservation can make studies of the health and diseases of these individuals challenging. Since various health conditions and diseases will affect only particular body parts, we wanted to determine whether protein analyses can distinguish between individual mummified human organs or body tissues. We investigated if the proteome obtained from the individual samples allowed us to infer the type of tissue or organ system from which it originated. Furthermore, we gained insights into what remained of the ancient individual's immune system. To accomplish this, we studied a medieval mummy recovered from the Altai Mountains by extracting proteins from nine disparate regions of the body. Samples were extracted in a dedicated clean laboratory for ancient protein research at the Institute of Evolutionary Medicine at the University of Zurich. The resulting peptides were analyzed via liquid chromatography and tandem mass spectrometry at the Functional Genomics Center Zurich. We assessed and presented the overall proteome for each sample and determined which types of proteins (structural, immune-related, blood, and bacterial) persist in these tissues and whether they are indicative of one or several tissue types. Here, we demonstrate that a wide range of human host proteins can be recovered from what appears to be poorly preserved remains.

CORRESPONDENCE TO: **patrick.eppenberger@iem.uzh.ch**

A 29

Oral health in Medieval Europe explored through paleoproteomics

Pedergnana, Antonella (Institute of Evolutionary Medicine / Swiss Mummy Project, University of Zurich, Zurich, Switzerland); Wilkin, Shevan (Institute of Evolutionary Medicine, University of Zurich, Zurich, Switzerland); Grossmann, Jonas (Functional Genomics Center Zurich, ETH Zurich - University of Zurich, Switzerland); Eppenberger, Patrick (Institute of Evolutionary Medicine, University of Zurich, Zurich, Switzerland); Rühli, Frank (Institute of Evolutionary Medicine, University of Zurich, Zurich, Switzerland);

Paleoproteomics, the large-scale study of proteins in ancient biological specimens, is a powerful tool for reconstructing past human lifestyles. Proteins extracted from ancient dental calculus may provide clues to an individual's dietary habits and general oral status. Oral pathologies found in human skeletal and dental remains can be diverse and result from multiple causes.
In studies of present-day populations, dysbiotic oral microbiomes with overabundant pathogenic bacterial species have been identified as an important etiological factor, particularly for developing carious lesions or periodontal disease. Red complex bacteria, for example, are well known to contribute to developing periodontitis and streptococcus mutans to tooth decay. However, several other bacterial species have also been identified in affected patients, but their association with oral health is less clear.
Therefore, an inter-populational analysis of ancient and historical microbiome signatures might identify clusters of pathogenic species linked to specific oral conditions.
This study examined human remains from two Medieval cemeteries, Baar-Fruebergstrasse (Canton of Zug, Switzerland) and Dalheim (North Rhine-Westphalia, Germany). Oral pathologies were documented by macroscopic anthropological analysis. Oral microbiomes were reconstructed by shotgun proteomic analysis of dental calculus and using proteotypic peptides from a tailored database to maximize ancient oral microbiome protein identification.
Preliminary results show that proteins are variably preserved, which may impact the overall reconstruction of oral health. Therefore, using multianalytical methods in paleopathology is desirable as it might help overcome issues related to poor preservation or interpretation of challenging samples.

CORRESPONDENCE TO: **antonella.pedergnana@iem.uzh.ch**

A 30

Reconsidering additional sources of ancient DNA

Sarhan, Mohamed (Institute for Mummy Studies, Eurac Research, Bolzano, Italy); Samadelli, Marco (Institute for Mummy Studies, Eurac Research, Bolzano, Italy); Hotz, Gerhard (Natural History Museum of Basel, Basel, Switzerland); Francken, Michael (State Office for Cultural Heritage Baden-Württemberg, Konstanz, Germany); Zink, Albert (Institute for Mummy Studies, Eurac Research, Bolzano, Italy); Maixner, Frank (Institute for Mummy Studies, Eurac Research, Bolzano, Italy);

Molecular analyses of mummies and skeletal remains, particularly DNA-based analyses often involve destructive sampling, which sometimes hinders research due to cultural heritage preservation concerns especially with the precious samples. Therefore, attempts to minimize the initial sampling materials are continuously required. Here, we present three different cases where we performed unusual non-destructive sampling on ancient mummies and skeletal remains, by extending the sampling objects to the surroundings as follows: Case (i) during the thawing process of the Iceman mummy of Bolzano, Italy, we gradually collected the thawed water and swabbed the whole body surface; Case (ii) to analyze the possible case of death of the Barfüsser mummy of Basel, Switzerland, we collected maggots, textiles, and soil samples from the surroundings of the mummy as negative controls; Case (iii) we analyzed the calcite deposits found surrounding Bronze Age human skeletal remains found in the Wimsener caves, Germany. In comparison with classical bone/tissue samples from the aforementioned cases, the new samples were enough to reconstruct full mitochondrial genomes of the individuals, to molecularly identify the sex, and finally to reflect microbial profiles including both ancient and modern contaminants. In conclusion, for performing DNA analyses on mummies or skeletal remains, sampling the surrounding objects could offer new possibilities which can give comparable results to the conventional sampling, in terms of the host DNA or even the inhabiting microbes. This offers additional options for non-destructive sampling which could convince the stakeholders and open new possibilities for performing research on highly precious mummies and ancient objects.

CORRESPONDENCE TO: **mohamed.sarhan@eurac.edu**

SESSION 6:

Egyptian mummies

A 31

Sustainable Mummy Studies: Capacity Building Activities in Egypt

Rühli, Frank (Swiss Mummy Project, Institute of Evolutionary Medicine, University of Zurich, Zurich, Switzerland); Eppenberger, Patrick (Swiss Mummy Project, Institute of Evolutionary Medicine, University of Zurich, Zurich, Switzerland); Tomoum, Nadja (Swiss Mummy Project, Institute of Evolutionary Medicine, University of Zurich, Zurich, Switzerland); Ibrahim, Mahmoud (Swiss Mummy Project, Institute of Evolutionary Medicine, University of Zurich, Zurich, Switzerland); Seiler, Roger (Swiss Mummy Project, Institute of Evolutionary Medicine, University of Zurich, Zurich, Switzerland);

Studies of ancient mummies often include fieldwork in foreign locations. We believe, that capacity building efforts actively involving local communities are a vital element of a long-term sustainable research environment, for both, archeological and conservation purposes. This solidaric approach is of particular relevance for regions having undergone colonialistic experiences in historic times. The Swiss Mummy Project has a long tradition of conducting mummy research also under such regional premises. The aim of this presentation is to highlight the various efforts we take to support local capacity building. Our recent capacity building activities are based on a Memorandum of Understanding between the University of Zurich and the Supreme Council of Antiquities (Egyptian Ministry of Tourism and Antiquities). Specifically, it includes e.g., mutual laboratory visits, the production of a field manual (for archaeologists and museum practitioners), as well as multiple training workshops at various locations in Egypt (e.g., Saqqara or Bahariya Oasis). The consolidation of local knowledge related to mummy studies is also important to promote local awareness and subsequently willingness in preserving these precious remains. Based on our experience we thus highly recommend similar approach to any institution doing mummies studies.
Funding: Swiss Federal Office of Culture (Grant # FH1909, 2020).

CORRESPONDENCE TO: **frank.ruehli@iem.uzh.ch**

A 32

The Necropolis of the Coptic Monastery of St. Paulos (Deir el-Bachît) at Western Thebes, Egypt. State of research and current results

Hobel, Tina (Department of Ancient History, Papyrology and Epigraphy, University of Vienna, Vienna, Austria);

The monastery of St. Paulos (Deir el-Bachît) is the largest known Coptic monastic complex at Western Thebes, Upper Egypt. It is situated on the hill of Dra' Abu el-Naga and consist of a coenobitic monastery and hermitages inhabited by individual monks (so-called Units XXVI and XXVII). The monastic settlement originates in these hermitages that were built into older pharaonic tombs in the late 5th century. The pottery and written sources found on site indicate that the monastery was inhabited from the late 6th / early 7th century until the beginning of the 10th century AD.
The necropolis is located to the east of the monastery and extends over an area of about 30 x 40 metres. Since it was not built over in modern times, it is well suited for extensive investigations of both funerary architecture and buried individuals. This is all the more important as only a few monastic cemeteries have been investigated throughout Egypt and the focus has mainly been on textiles and grave goods. In several campaigns between 2005 and 2021, a German-Austrian team uncovered about 100 graves and a central square on the hilltop. Although many of the graves had been looted during illegal excavations, over 30 individuals have been discovered in their graves. This paper aims to give an overview of their archaeological context.

CORRESPONDENCE TO: **tina.hobel@univie.ac.at**

A 33

The Human remains of the Coptic Monastery Complex in Deir el-Bachît in Thebes-West

Lösch, Sandra (Department of Physical Anthropology, Institute of Forensic Medicine, University of Bern, Switzerland, Bern, Switzerland); Hower-Tilmann, Estelle (Department of Physical Anthropology, Institute of Forensic Medicine, University of Bern, Switzerland, Bern, Switzerland); Zink, Albert (Institute for Mummy Studies, Eurac Research, Bolzano, Italy);

Deir el-Bachît is the largest known Coptic monastery complex in Western Thebes, Upper Egypt, dating to the Late Antiquity, between the late 6th and the early 9th century AD. A team of the ÖAW in cooperation with the DAI excavated the site between 2005 and 2021 and they were able to assign it to the monastery of St. Paulos. So far, 43 individuals were excavated in the associated necropolis and four individuals were found in other contexts of the complex. Our anthropological study showed that all individuals are males with an average age-of-death of approx. 30 to 50 years. Most of them suffered from diverse pathological conditions, such as caries, arthrosis and spondylosis. We found different states of preservation of the corpses, ranging from intact mummification to partial mummified bodies and skeletonised individuals. The former embalmers wrapped the mummies into five to seven layers of linen sheets of approx. 2m length. They rolled the fabric up at the feet and the head of the dead, which leads to the typical prominent face region. We detected juniper berries and salt between the linen layers and on the body surface. In addition, we found bitumen-like substances on and in the body, especially near the body cavities. However, we did not find signs for evisceration, such as incisions, excerebration or cavity packing. From literature, we learn that substances such as resin and bitumen ointments were generally no longer used after the Roman Period. Apparently, the Christian community still practiced a kind of mummification.

CORRESPONDENCE TO: **sandra.loesch@irm.unibe.ch**

A 34

Burial patterns and social structures in Late Antiquity. The necropolis of the Paulos Monastery/Upper Egypt

Tatz, Sabrina (Dölger-Institut for Late Antique Research, Bonn University, Bonn, Germany)

Since 2005, the necropolis of the Paulos Monastery (Deir el-Bachit), a late antique monastic complex (6th-10th c.) in Thebes, Upper Egypt, has been investigated within the context of a DAI/ÖAI excavation project. Anthropological investigations by S. Lösch, E. Hower-Tilmann, and A. Zink confirmed that the burial site was mainly occupied by adult male individuals, allowing the assumption of a merely monastic burial site. These investigations gave important evidence for the thorough treatment of the deceased. In the context of a PhD thesis, these will now be embedded in a broader context of Rites de Passage, which, in addition to the embalming of the body, focus on its wrapping in cloths and the further process of burial. The focus of this paper will be on the textiles and their wrapping, which allow further conclusions on the social structures of the monastic community. Although each deceased was given a minimum standard of care that was uniform throughout the ages, specific shrouds, individual costume items, or even "burial garments" were limited to designated social groups. The exact position or draping of these individual "insignia" within the wrapping was predetermined.
Until now, Egyptian mummies of the post-Pharaonic period have been disregarded by researchers. The burials of Deir el-Bachit show that even in "Coptic" times, the corpses were treated more elaborately than had long been assumed. The necropolis of the Paulos Monastery offers a rare opportunity to study the practice of embalming in the transition to the Islamic period within its archaeological and social context.

CORRESPONDENCE TO: **statz@uni-bonn.de**

A 35

Four thousand years of maternal ancestry in ancient Egypt illuminated by mitochondrial genome sequencing

Mussauer, Alexandra (Institute for Mummy Studies, Eurac Research, Bolzano, Italy); Wurst, Christina (Institute for Mummy Studies, Eurac Research, Bolzano, Italy); Paladin, Alice (Institute for Mummy Studies, Eurac Research, Bolzano, Italy); Coia, Valentina (Institute for Mummy Studies, Eurac Research, Bolzano, Italy); Maixner, Frank (Institute for Mummy Studies, Eurac Research, Bolzano, Italy); Helmbold-Doyé, Jana (Ägyptisches Museum und Papyrussammlung, Staatliche Museen zu Berlin, Berlin, Germany); Del Vesco, Paolo (Museo Egizio, Fondazione Museo delle Antichità Egizie di Torino, Turin, Italy); Rosendahl, Wilfried (Reiss-Engelhorn-Museen Mannheim, Mannheim, Germany); Zink, Albert (Institute for Mummy Studies, Eurac Research, Bolzano, Italy);

During the last decade, the population genetic history of ancient Egypt has been illuminated by an increasing number of genetic studies on ancient Egyptian human remains from different time periods utilizing high-throughput sequencing methods. Nonetheless, mitochondrial genomes representative of the Egyptian population prior to the New Kingdom (1550 - 1069 BC) are still scarce. Therefore, in this study, we analyzed samples taken from 99 ancient Egyptian mummified or skeletonized individuals housed in the collections of the Museo Egizio of Turin and the Egyptian Museum and Papyrus Collection of the Staatliche Museen zu Berlin. These individuals have been recovered from different archaeological sites in Egypt and encompass a timeframe ranging from about 4000 BC to AD 800. All samples were analyzed using next-generation sequencing methods, including mitochondrial DNA enrichments. Following the application of criteria for authenticity and quality control, we were able to reconstruct 34 mitochondrial genomes of ancient Egyptian individuals, predominantly from southern Egypt, that have been dated from the Predynastic to the Byzantine Period (3600 BC - AD 650). Our data supports the presence of western Eurasian and northeastern African mitochondrial haplogroups in Egypt throughout antiquity. Furthermore, the mitochondrial genomes extend the pool of available datasets, adding novel information for the older periods of Egypt's past as well as for a broader geographical context. Thereby, this study constitutes another important step for the reconstruction of Egypt's genetic history, which in the future could be further investigated by genome-wide studies.

CORRESPONDENCE TO: **alexandra.mussauer@eurac.edu**

A 36

Radiological analysis of the Warsaw mummy's alleged pregnancy, with a broader study of the radiological, archaeological and Egyptological context

Braulinska, Kamila (Faculty of Archaeology, University of Warsaw, Warsaw, Poland); Kownacki, Lukasz (Department of Diagnostic Imaging, European Health Center Otwock, Otwock, Poland); Ignatowicz-Wozniakowska, Dorota (Department of Conservation, National Museum in Warsaw, Warsaw, Poland); Kurpik, Maria (Department of Conservation, National Museum in Warsaw, Warsaw, Poland);

The announcement in 2021 of the discovery of an intact 26–30 week fetus inside the pelvis of one of the mummies investigated by the Warsaw Mummy Project quickly went viral globally with the participation of such publishers, agencies and media as Elsevier, Reuters, Science, Nature, Smithsonian Magazine, National Geographic, BBC, CNN, Business Insider, New York Times, Current World Archaeology, and a myriad of others around the world. However, this outcome was not consulted with a radiology specialist prior to its announcement. The reaction of other researchers and associates of the Warsaw Mummy Project was to launch immediately a proper radiological and archaeological investigation of the case.
The prime objective of the paper is to present the results of a properly carried out CT data analysis of the contents of the pelvis of the mummy from the National Museum in Warsaw collection (on long-term loan from the University of Warsaw). The results demonstrate beyond all doubt that the object in the pelvic area of the mummy is not a baby.
The pregnancy theory is also dismissed by the findings of an extensive survey of the archaeological and Egyptological evidence for the proposed fetus model, as well as by a review of modern radiological cases. The paper also points out the unconvincing nature of the "bone dissolution" idea proposed by the advocates of the pregnancy theory.

CORRESPONDENCE TO: **ks.braulinska@uw.edu.pl**

SESSION 7:

Imaging, Biomedicine & Conservation

A 37

Medical Conditions in Ancient People: CT Paleopathology Pictorial Essay in Mummies

Sutherland, M Linda (MemorialCare Heart & Vascular Institute, MemorialCare, Fountain Valley, CA, U.S.A.); Sutherland, James D (MemorialCare Heart & Vascular Institute, MemorialCare, Fountain Valley, CA, U.S.A.); Thomas, Gregory (MemorialCare Heart & Vascular Institute, MemorialCare, University of California, Irvine, Fountain Valley, CA, U.S.A.); Wann, L. Samuel (Division of Cardiology, University of New Mexico, Albuquerque, U.S.A.); Allam, Adel (Department of Cardiology, Al Azhar University, Cairo, Egypt); Miyamoto, Michael (Division of Cardiology, Mission Heritage Medical Group, Providence Health, Los Angeles, CA, U.S.A.); Rowan, Chris (Renown Institute for Heart and Vascular Health, Reno, Nevada, U.S.A.); Michalik, David (Miller Children's and Women's Hospital, University of California, Irvine, Long Beach, CA, U.S.A.); Finch, Caleb (Ethel Percy Andrus Gerontology Center, University of Southern California, Los Angeles, CA, U.S.A.); Zink, Albert (Institute for Mummy Studies, Eurac Research, Bolzano, Italy); Lombardi, Guido (Laboratorio de Paleopatologia, Catedra Pedro Weiss, Universidad Peruana Cayetano Heredia, Lima, Peru); Thompson, Randall (Cardiology, St. Luke's Mid America Heart Institute, Kansas City, U.S.A.);

Mummification techniques differ between and within cultures resulting in variable preservation of soft tissues in ancient mummies. CT findings of orthopedic conditions are more reliably identified and therefore more extensively studied than other paleopathologic findings. However, medical conditions can be detected on CT scans of adequately preserved mummies. The HORUS StudyTeam reviewed over 268 CT scans of mummified ancient individuals from Egypt, Peru, Mongolia, two sites in North America, and Australia systematically searching for signs of atherosclerosis, but also observing other medical conditions. We report here on these conditions.
Results: Whole body CT scans of adult mummies, (n=268),majority from ancient Egypt and Peru, dating from 3000 BCE to 1000 CE, had a wide range of levels of preservation, but at least some soft tissue present. Medical conditions identified include gallstones, smallpox, secondary syphilis, osteomyelitis, mastoiditis, Brody's cyst, multiple myeloma, tuberculosis, cataracts , drusen, thalassemia, and a liver cyst suggesting ecchinochocosis.
Conclusion: This Pictorial Essay of Paleopathology documents a wide range of medical conditions in ancient people.

CORRESPONDENCE TO: **heartrct@gmail.com**

A 38

Ten Ancient Mummies with Extensive Atherosclerosis on CT Imaging: A Pictorial Essay

Thompson, Randall (Cardiology, St. Luke's Mid America Heart Institute, Kansas City, U.S.A.); Wann, L. Samuel (Division of Cardiology, University of New Mexico, Albuquerque, U.S.A.); Sutherland, M Linda (MemorialCare Heart & Vascular Institute, MemorialCare, Fountain Valley, CA, U.S.A.); Allam, Adel (Department of Cardiology, Al Azhar University, Cairo, Egypt); Sutherland, James D (MemorialCare Heart & Vascular Institute, MemorialCare, Fountain Valley, CA, U.S.A.); Frohlich, Bruno (Smithsonian Institution, Washington, DC, U.S.A.); Miyamoto, Michael (Division of Cardiology, Mission Heritage Medical Group, Providence Health, Los Angeles, CA, U.S.A.); Rowan, Chris (Renown Institute for Heart and Vascular Health, Reno, Nevada, U.S.A.); Michalik, David (Miller Children's and Women's Hospital, Horus Group Long Beach, CA, U.S.A.); Finch, Caleb (Ethel Percy Andrus Gerontology Center, University of Southern California, Los Angeles, CA, U.S.A.); Zink, Albert (Institute for Mummy Studies, Eurac Research, Bolzano, Italy); Lombardi, Guido (Laboratorio de Paleopatologia, Catedra Pedro Weiss, Universidad Peruana Cayetano Heredia, Lima, Peru); Thomas, Gregory S. (MemorialCare Heart & Vascular Institute, MemorialCare, University of California, Fountain Valley, CA, U.S.A.);

Although atherosclerosis is usually thought of as a disease of modern times and related to modern lifestyles, it has been shown to have been present in ancient people. The HORUS Team reviewed over 300 CT scans of mummified ancient individuals, systematically searching for the presence of atherosclerosis. We present here extensive atherosclerosis observed in ten individuals.
Results: The individuals presented all had atherosclerotic calcifications in multiple vascular beds. The cases include: calcification of the intracerebral internal carotid arteries, heavy bilateral carotid bulb calcifications, bilateral subclavian artery calcifications, particularly heavy coronary calcifications, calcified myocardial infarction, probable aneurysms, and extensive calcification of the abdominal aorta, mesenteric arteries, iliac bifurcation, common iliac arteries, superficial femoral arteries, and Monckeberg's arterial sclerosis of the arteries of the legs.
Conclusion: While atherosclerosis is often viewed as a disease of modern times, these data indicate some individuals in ancient times undoubtedly suffered from clinical disease.

CORRESPONDENCE TO: **heartrct@gmail.com**

A 39

Orofacial pathologies in two temporally disjunct population samples in the Temple of Millions of Years of Thutmosis III in Western Thebes, Egypt

Seiler, Roger (Institute of Evolutionary Medicine/Swiss Mummy Project, University of Zurich Zurich, Switzerland); Eppenberger, Patrick (Institute of Evolutionary Medicine/Swiss Mummy Project, University of Zurich Zurich, Switzerland); Rühli, Frank (Institute of Evolutionary Medicine/Swiss Mummy Project, University of Zurich Zurich, Switzerland);

Since the beginning of the Thutmose III Temple Project in 2008, its primary objective has been to conserve and restore temple buildings and artifacts. However, since the Temple of Millions of Years is situated within the vast necropolis surrounded by the "Khokha" and "Assassif" hills, two burial grounds have been discovered underneath, which can be assigned to different periods. Most of the tombs date to the XI Dynasty from the end of the First Intermediate Period to the beginning of the Middle Kingdom (2160 - 1985 AD), while the later tombs date to the Third Intermediate Period (948 - 715 BC) and the Late Period (725 - 525 BC). The human remains from these two cemeteries, considerably separated in time and belonging to different social classes, were inventoried and anthropologically classified, and their dental and orofacial status was recorded. The detailed analysis of the incidence of dental wear, particularly dental caries, as a multifactorial disease, provided valuable insights. We report on the methodology used to record and analyze these conditions and attempt to interpret the two population samples' varying states of oral health.

CORRESPONDENCE TO: **patrick.eppenberger@iem.uzh.ch**

A 40

Mummy of vizir Imhotep: interdisciplinary study and restoration work

Facchetti, Federica (Fondazione Museo delle Antichità Egizie di Torino, Torino, Italy); Paladin, Alice (Institute for Mummy studies, Eurac Research, Bolzano, Italy); Aicardi, Sara (Collezione e Ricerca, Fondazione Museo Delle Antichità Egizie di Torino, Torino, Italy); Manzollino, Roberta (Archeo&Arte3D DigiLab, Sapienza University of Rome, Rome, Italy); Sutherland, M Linda (MemorialCare Health Systems, The Horus Group, Santa Ana, U.S.A.); Wurst, Christina (Institute for Mummy studies, Eurac Research, Bolzano, Italy); Mussauer, Alexandra (Institute for Mummy studies, Eurac Research, Bolzano, Italy); Samadelli, Marco (Institute for Mummy studies, Eurac Research, Bolzano, Italy); Zink, Albert (Institute for Mummy studies, Eurac Research, Bolzano, Italy); Greco, Christian (Collezione e Ricerca, Fondazione Museo Delle Antichità Egizie di Torino, Torino, Italy);

Imhotep, as vizier at the court of Pharaoh Thutmosis I, held the highest office in the Egyptian administration, according to textual and archaeological sources. Imhotep's discovery dates to 1904, when his mummy was found in the Valley of the Queens (QV46) in Thebes (Egypt) by the then director of the Museo Egizio in Torino, Italy, Ernesto Schiaparelli. At that time, the burial had been plundered and the body of Imhotep was desecrated. In 1923, the mummy and its grave goods were transported to Turin. In 2017, a collaboration between the Museo Egizio and other institutions, including the Institute for Mummy Studies of Eurac Research of Bolzano, Italy, began an interdisciplinary research project (Egyptology, conservation, anthropology, genetics, geochemistry) that involved not only the mummy of Imhotep, but also the entire collection of the preserved human remains of the Museo Egizio. Through the use of computed tomography (CT) scans, the biological (male, 35-45 years old) and paleopathological (e.g., oral diseases, atherosclerosis) profile of Imhotep was reconstructed, as well as investigation of the embalming technique. The study revealed an unexpected radiocarbon dating of Imhotep that is older than that known for the reign of Thutmosis I. In addition, in 2021, the body of Imhotep underwent complex restoration work (from both a conservation and an ethical point of view) in preparation for the installation of a new exhibition room in the Museo Egizio, named Alla ricerca della vita.

CORRESPONDENCE TO: **federica.facchetti@museoegizio.it**

A 41

Study of Egyptian mummies in context. An assemblage of the beginning of 18th dynasty

Mérigeaud, Samuel (Groupe CRP/Vidi, Directeur de Tridilogy, Montpellier, France); Hartenstein, Cassandre (Insitut d'égyptologie, UMR 7044 Archimède, Université de Strasbourg, Strasbourg, France); Colin, Frédéric (Insitut d'égyptologie, University of Strasbourg, Strasbourg, France);

In 2018 and 2019, an archaeological team of the Institut français d'archéologie orientale and the Strasbourg University discovered in Luxor (in the valley of al-Asasif) five intact coffins, buried under the sacred causeway departing from Thoutmosis III's temple in Deir el-Bahari (XVIIIth dynasty, around 1650 BC). Each sarcophagus contained one mummy and four of them contained funerary objects. The archaeologists used a method of digitization to document the gestures performed by the ancient Egyptians to install the funerary equipment in each coffin.
In 2021, a study mission took place, with the support and collaboration of Tridilogy, CRP Group/ Vidi Group, and aimed to X-ray the five mummies, kept in two different storage facilities in Luxor, with transportable equipment, directly in their sarcophagus, to avoid any possible deterioration secondary to manipulation. The study of the mummies was completed by analyses of the wood of the coffins and radiocarbone dating of the textiles are under investigation.
The first results of the bioarchaeological operation show the mummies did not received equally treatment. For instance, one of them has numerous adornment elements and some jewels while one other has none and seems to have been subject to post-mommification movements. The study will show the significance of this interdisciplinary study for the comprehension of the history of the bodies buried under Thoutmosis III' causeway.

CORRESPONDENCE TO: **hcassandre@gmail.com**

A 42

Conserving Egyptian Mummies: A Difficult Relationship Between Past and Present

Olivia, Cinzia (Torino, Italy)

The international debate about the exhibition of human remains had aroused ethical conflicts and issues about the opportunity of having dead bodies on display.
Most of these problems came from the legacies of colonialism, but due to an increasing pressure from the media and the public, we are obliged to find a satisfactory balance between the respect that a human body deserves and allowing the visitor to get a full understanding of it.
As conservators, we all agreed to adhere to a general code during the handling, storage and display of human remains. Furthermore, most of the Egyptian mummies underwent some sort of damage and pillaging, and consequent conservation treatments. Today, we face many problems: do we remove or conserve these treatments? At the same time, we must decide whether to change the original displays according to the new procedures of displaying textiles connected to human remains.
The topic will be illustrated through examples from different museums in Italy (Turin, Naples, Vatican Museum, Venice), in different states of preservation (pillaged, unwrapped, fake mummies) and the many methods which have been used to used to conserve them, related to their cultural and anthropological context in which they arrived and are nowadays displayed.
All the artefacts exhibited signs of damage which caused physical and chemical breakdown in the fibres and the mummies. They were all cleaned and consolidated and when necessary, a proper mechanical support was made, in order to sustain and conserve the mummy.

CORRESPONDENCE TO: **oliva.c@libero.it**

SESSION 8:

Museums & Conservation

A 43

Study of Corposanto – relics of St.Bonifatius, Holy Martyr

Maslauskaite-Mažyliene, Sigita (Church Heritage Museum, Vilnius, Lithuania); Jankauskas, Rimantas (Anatomy, Histology and Anthropology, Vilnius University, Vilnius, Lithuania); Sargent Noyes, Ruth (Nationalmuseum of Denmark, Copenhagen, Denmark); Brindzaite, Ruta (Faculty of History, Vilnius University, Vilnius, Lithuania); Miliauskiene, Žydrune (Faculty of Medicine, Vilnius University, Vilnius, Lithuania); Kozakaite, Justina (Faculty of History, Vilnius University, Vilnius, Lithuania);

A study of the human-shape body, dressed as Roman soldier - relics of St.Bonifatius, located in Valkininkai rural church from 18th c., was performed. To preserve unique settings, only visual inspection and X-ray analysis took place, and two bone samples available were taken for radiocarbon dating. Results revealed that the body was constructed from organic fiber, wax and metal wires, using parts of skeleton of at least three individuals, and placing them in a very approximate anatomical positions (e.g., confusing proximal and distal ends, missing small bones of hands and feet, loose random bones in thoracic, abdominal and pelvic areas). At least two postmortally lost teeth were replaced by wax models. Radiocarbon dates pointed to 3rd-5th centuries AD (1717±26 and 1692±26 uncal.BP). It appears that corpisanti were serially produced as luxury artworks under the Catholic Church's purview c. 1750-1850 in as-yet unidentified workshops in Rome that employed multilayered techniques. However, human bones as actual relics for such sculptures were excavated and collected from original Roman catacombs. Though the precise number of corpisanti manufactured c. 1750-1850 remains unknown, they possibly totalled in thousands and were globally distributed via multidimensional administrative and patronage networks across over 20 countries on 5 continents, constituting a veritable global invasion or 'catacombization.' Cases of their reception, translation and transformation across Europe, in the colonial Americas and neocolonial borderlands of East-Central Europe bespeak their crucial mediating role in transcultural contact zones.

CORRESPONDENCE TO: **rimantas.jankauskas@mf.vu.lt**

A 44

Presenting the Faces of Preserved Human Remains: Ethical, Academic and Practical Challenges

Wilkinson, Caroline (Face Lab, Liverpool John Moores University, Liverpool, United Kingdom)

Preserved human remains hold specific challenges for craniofacial analysis associated with degradation of skeletal material, access difficulties and post-mortem changes. However, accidental and/or deliberate preservation processes also offer unique visual information associated with soft tissue features, hair and accessories.
In addition, many museums around the world are critical of the exhibition of human remains, and the presentation of faces of the dead can be viewed as unnecessary and exploitative.
This paper will discuss the ethical, practical and academic challenges associated with craniofacial analysis and facial depiction of preserved human remains and will be illustrated with examples, including Ancient Egyptian Pharaohs, Northern European Bog Bodies, South American Tsantsa and natural mummies.

CORRESPONDENCE TO: **c.m.wilkinson@ljmu.ac.uk**

A 45

Mummification in the Mesolithic. New Approaches to Old Photo Documentation Reveal Previously Unknown Mortuary Practices in the Sado Valley, Portugal

Peyroteo Stjerna, Rita (Human Evolution, Department of Organismal Biology, Uppsala University, Uppsala, Sweden); Nilsson Stutz, Liv (Department of Cultural Sciences, Linnaeus University, Växjö, Sweden); Mickleburgh, Hayley (Department of Cultural Sciences, Linnaeus University, Växjö, Sweden); Cardoso, João Luís (Universidade Aberta, Lisboa, Portugal);

Mummification as a funerary practice was probably more common in prehistory than it is usually acknowledged. The scarcity of preserved soft-tissue makes it difficult to identify such practices in archaeological contexts without historical records.
Recently rediscovered photographs of the remains of thirteen individuals excavated in the 1960s in the Sado Valley Mesolithic shell middens in Portugal, show the potential of revisiting excavation archives with new methods. Our analysis, which applies the principles of archaeothanatology and is enriched by experimental taphonomic research indicates that some bodies may have been mummified prior to burial, a phenomenon possibly linked to their curation and transport, highlighting the significance of both the body and the burial place in Mesolithic Portugal, c. 8000 years ago. In this paper, we present evidence for pre-burial treatments such as desiccation through mummification which has not been suggested for the Mesolithic before.

CORRESPONDENCE TO: **rita.peyroteo.stjerna@gmail.com**

A 46

Agency and corporality in the mortuary treatment of Chinchorro infants of the Atacama's coast desert

Silva-Pinto, Verónica (Museo Nacional de Historia Natural de Chile, Santiago, Chile); Castro, Mario (Museo Nacional de Historia Natural de Chile, Santiago, Chile); Caceres, Constanza (Museo Nacional de Historia Natural de Chile, Santiago, Chile); Reyes-Madrid, Margarita (Museo Nacional de Historia Natural de Chile, Santiago, Chile); Salazar-García, Domingo Carlos (Grupo de Investigación en Prehistoria IT-1223-19 (UPV-EHU)/IKERBASQUE-Basque Foundation Science, University of Valencia, Valencia, Spain);

Chinchorro were a society of Hunters, Gatherers and specialized Fishermen who settled along the northern coast of Chile and south of Peru, before 7,500 BP until about 3,660 BP. Chinchorro bodies with complex treatment have been recognized as the oldest artificial mummies in the world and some of their archaeological sites have recently been declared a World Heritage Site by UNESCO.
The handling of the Chinchorro bodies has been extensively studied around its mortuary practices, especially from a typological logic, which has made invisible the great variability of existing mortuary treatments.
This analysis was performed on a total of 16 infant Chinchorro bodies from Museo Nacional de Historia Natural from Chile through CT scan and dating by AMS.The basic treatment of most part of the bodies included removing the organs, defleshing, cleaning the bones, reassembling the skeleton and filling it with vegetable fibers and/or sediments. The human skin was repositioned or sometimes replaced for animal skin and a wig was created from strands of human hair (not necessarily from the same individual).
After analyzing the results as a whole and following the spatial, chronological, biochemical, morphological and stylistic considerations addressed, it has been verified that the vast variety observed in Chinchorro mortuary treatments is not related to chronological and/or spatial differences. This allows us to propose that in the different stages of the reconstruction of the bodies, innovative elements are being incorporated, evidencing a collective effort of the family nucleus itself in the manufacture of the bodies.

CORRESPONDENCE TO: **veronica.silva@mnhn.gob.cl**

A 47

Conservation process of the mummy from Cajamarquilla, Peru

Gutierrez Espinola, Donal Mauricio (Universidad Nacional Mayor De San Marcos, Lima, Peru);
Huaman Santillan, Yomira Silvia (Universidad Nacional Mayor De San Marcos, Lima, Peru);
Van Dalen Luna, Pieter (Universidad Nacional Mayor De San Marcos, Lima, Peru);

In 2021, an important discovery was made in the Cajamarquilla archaeological complex, located within the City of Lima in Peru. It is a funerary context made up of a mummified individual placed inside a funerary cist. After recovery, the mummy was taken to the rooms of the National University of San Marcos where conservation work was carried out. This is the first intervention in mummies that has been carried out in Peruvian territory since there are no antecedents in this regard. As there were no antecedents, a complete bibliographic review of international cases was carried out to determine the methodology to be followed.
The conservation diagnosis has been carried out, identifying the conservation pathologies and the main agents of deterioration. Cleaning, disinfection, consolidation and reintegration work was carried out; all this according to international protocols established for other cases of mummification. In addition to the intervention on the body of the mummy, conservation work was also carried out on the directly associated materials, such as the ropes that tied the body and the textiles. Likewise, the support of the mummy was conditioned so that it could not have complications during the exhibition process in the museum of the San Marcos University.

CORRESPONDENCE TO: **donalgutierreze@gmail.com**

A 48

Conducting experiments at the Australian Facility for Taphonomic Experimental Research (AFTER) for a better understanding of mummification practices

Schotsmans, Eline (Centre for Archaeological Science, University of Wollongong, Wollongong NSW, Australia);

Mortuary treatment of the dead provides key insights into human behaviour, social organisation and ideology of past societies. Unfortunately there are numerous shortcomings in the study of funerary archaeology. A major deficiency is that the archaeological record only shows the final deposition of human remains. The way human remains were treated before their final deposition, such as all forms of exposure of corpses and pre-burial mummification, remains difficult to detect.
In archaeo-anthropology, observations of diagenetic alterations in bone microstructure, known as histotaphonomy, are increasingly used to reconstruct post-mortem processes, such as intentional mummification prior to interment. This approach is, however, the subject of ongoing discussions, with limited experimental data published to date. This presentation discusses the experimental design and outcomes of actualistic experiments with human remains conducted at the Australian Facility for Taphonomic Experimental Research (AFTER) from an interdisciplinary perspective. The aim is to increase our understanding of the processes that lead to complete mummification and superficial desiccation, and their diagenetic signatures in bone. Results confirm that a specific combination of weather conditions and body placement is essential to promote complete natural mummification. The experiments also give insights on the specific stages of decomposition and timelines of mummification. The ultimate goal of this study is to develop, expand and validate methods for the identification of pre-burial mummification practices in the past.

CORRESPONDENCE TO: **eline@uow.edu.au**

PUBLIC LECTURE:

Egypt's Royal Mummies: From Discovery to Display(s)

Ikram, Salima (Department of Sociology, Egyptology and Anthropology, American University in Cairo, Cairo, Egypt);

It is rare to look upon the actual face of ruler, let alone one who has been dead for over three thousand years, yet this is possible when it comes to the kings of ancient Egypt. A cache of royal mummies was discovered in the 1870s and brought to the Egyptian Museum in 1881, and another one found in 1898. This lecture traces the history of the royal mummies from the time of their discovery until the present, including their roles as grand historic figures, objects of scientific inquiry, ambassadors for Egypt, political symbols, nationalist icons, and economic mainstays, as exemplified in the remarkable procession of 2021 that took them from the Egyptian Museum to the National Museum of Egyptian Civilisation, where they now rest.

SESSION 9:

Mummies from Europe, the Near East & North Africa

A 49

Tollund Man's last meal: new analyses of his colon contents

Nielsen, Nina (Museum Silkeborg, Silkeborg, Denmark); Henriksen, Peter Steen (Department of Environmental Archaeology and Materials Science, The Danish National Museum, Copenhagen, Denmark); Mortensen, Morten Fischer (Department of Environmental Archaeology and Materials Science, The Danish National Museum, Copenhagen, Denmark); Enevold, Renée (Department of Archaeological Science and Conservation, Moesgaard Museum, Højbjerg, Denmark); Mortensen, Martin N. (Department of Environmental Archaeology and Materials Science, The Danish National Museum, Copenhagen, Denmark); Scavenius, Carsten (Department of Molecular Biology and Genetics, Aarhus University, Aarhus, Denmark); Enghild, Jan J. (Department of Molecular Biology and Genetics, Aarhus University, Aarhus, Denmark);

The ca. 2400-year-old Iron Age bog body Tollund Man was found in a raised bog in Bjældskovdal, Denmark in 1950. Already the same year, plant macrofossil analysis was conducted on the well-preserved gut contents, which suggested that the last meal of Tollund Man had been some kind of porridge containing remains from 16 different plants. However, only the larger fragments were analysed and no attempt was made to quantify the ingredients. We therefore decided to re-examine the gut contents in more detail and using new methods. The new investigation included analyses of plant macrofossils, pollen, non-pollen palynomorphs, steroid markers, and proteins from the colon contents. The main aim of the re-examination was to quantify the ingredients in his last meal and gain a better understanding of what an Iron Age meal may have contained. Additionally, we searched for unusual ingredients, explored the presence of weed seeds, and looked for evidence of food processing practices and intestinal parasites.
The investigation shows that 12–24 hours before Tollund Man was killed he ate a porridge containing mainly barley (Hordeum vulgare), pale persicaria (Persicaria lapathifolia s.l), and flax (Linum usitatissimum), with some fish. Although the meal may reflect ordinary Iron Age fare, the inclusion of threshing waste could possibly relate to ritual practices. Furthermore, eggs from three different intestinal worms show that he was infected with parasites.
The re-analysis illustrates that it can be well worth revisiting old gut contents stored in museums, as new techniques can shed fresh light on old questions.

CORRESPONDENCE TO: **ninaheltnielsen@gmail.com**

A 50

Revealing the "Maronite mummies" of Assi el Hadath Cave (Lebanon)

Zingale, Stefania (Institute for Mummy Studies, Eurac Research, Bolzano, Italy); Paladin, Alice (Institute for Mummy Studies, Eurac Research, Bolzano, Italy); Moroder, Ludwig (Microbiology and Virology Laboratory, South Tyrol Health Authority, Bolzano, Italy); Afeiche, Anne Marie (National Museum of Beirut, Beirut, Lebanon); Alam, Nathalie (National Museum of Beirut, Beirut, Lebanon); Coia, Valentina (Institute for Mummy Studies, Eurac Research, Bolzano, Italy); Zink, Albert (Institute for Mummy Studies, Eurac Research, Bolzano, Italy); Samadelli, Marco (Institute for Mummy Studies, Eurac Research, Bolzano, Italy);

In 1989, eight naturally mummified human bodies (three adults and five subadults) have been discovered in the Assi el-Hadath cave (Quadisha Valley, Lebanon), and then stored in the archive of the National Museum of Beirut. The mummies were archaeologically dated to the Middle Ages and later confirmed by radiocarbon dating (14C) to the end of the 13th century CE.
In the framework of an international cooperation project, financed by the Italian government and in collaboration with Eurac Research, Institute for Mummy Studies, the conservation conditions were evaluated and the mummies underwent a restoration work, in order to be exhibited in 2016 in the museum. The microbiological survey performed on the mummies revealed the presence of significant microbial activity. To prevent further microbial growth and to maintain appropriate conservation conditions (temperature and relative humidity) for the mummies, a protocol of ordinary and preventive maintenance was established.
Moreover, the genetic investigations (shotgun sequencing and mitochondrial DNA enrichment, mtDNA) allowed us: (1) to establish a good preservation of the aDNA samples (average human endogenous content: 7.43%); (2) to determine the biological sex of the mummies which resulted in four male and four female individuals, that differs from the archaeological data suggesting the prevalence of females in the cave; and (3) to suggest a maternal genetic relationship between four of the analyzed mummies based on the presence of identical mtDNA haplotypes.

CORRESPONDENCE TO: **zingalestefania@gmail.com**

A 51

An interdisciplinary study on the mummified and skeletonized human remains from three Portuguese cemeteries (19th-21st centuries)

Silva-Bessa, Angela (Laboratory of Forensic Anthropology, University of Coimbra, Coimbra, Portugal; UCIBIO-REQUIMTE, University of Porto, Porto, Portugal; TOXRUN, CESPU, Gandra, Portugal); Azevedo, Rui (LAQV-REQUIMTE, University of Porto, Porto, Portugal); Almeida, Agostinho (LAQV-REQUIMTE, University of Porto, Porto, Portugal); Madureira-Carvalho, Áurea (TOXRUN, CESPU, Gandra, Portugal; LAQV-REQUIMTE, University of Porto, Porto, Portugal); Dinis-Oliveira, Ricardo Jorge (UCIBIO-REQUIMTE University of Porto, Porto, Portugal; TOXRUN, CESPU, Gandra, Portugal; Faculty of Medicine, University of Porto; Porto, Portugal; MTG Research and Development Lab, Porto, Portugal); Forbes, Shari L. (Department of Chemistry, Biochemistry and Physics, University of Quebec at Trois-Rivières, Quebec, Canada); Ferreira, Maria Teresa (Laboratory of Forensic Anthropology, University of Coimbra, Coimbra, Portugal);

The cemeteries of Prado do Repouso, Boa Esperança, and Novo de Faro have been struggling with slow decomposition rates and a significant number of preserved remains. While the former cemetery is located in the North of Portugal and hosts both in-ground and above ground entombments, the other two are located in the Southern region of the country with the latter exclusively hosting sites of aerobic consumption. According to Portuguese law, if a body is not fully decomposed, inhumation must continue for successive periods of two years until skeletonization is achieved. The main goal of this work is to study the environmental conditions that have been contributing to the different stages of decay in the aformentioned cemeteries. A total of fifty-nine individuals were exhumed with the purpose of cremation or relocation to an ossuary as requested by their relatives. Age-at-death ranged from 8 to 90 years-old while postmortem interval fluctuated between 5 and 159 years. When available, hair and nails were sampled for elemental analysis, and grave soil was sampled for organic and inorganic characterization (organic matter content, colour, pH, electrical conductivity, humidity, bulk density, and elemental analysis). Soil, as an extrinsic factor, showed no subtstancial differences between graves of mummified and skeletonized individuals though high levels of metals were detected (Cu: mean = 249 µg/g, SD = 107; Hg: mean = 0.63 µg/g, SD = 0.5). It is expected that intrinsic factors may have influenced the different stages of decomposition, and toxicological analysis on hair and nails will be conducted.

CORRESPONDENCE TO: **ars.bessa@gmail.com**

A 52

A singular tomb in Pompeii. The inhumation and mummification of Marcus Venerius Secundio

Alapont Martin, Llorenç (Departament de Prehistòria, Arqueologia i Història Antiga, Universidad de Valencia, Valencia, Spain); Amoretti, Valeria (Laboratorio di ricerche applicate. Parco Archeologico di Pompei, Parco Archeologico di Pompei, Pompei, Italy); Zuchtriegel, Gabriel (Parco Archeologico di Pompei, Parco Archeologico di Pompei, Pompei, Italy); Gallello, Gianni (Departament de Prehistòria, Arqueologia i Història Antiga, Universidad de Valencia, Valencia, Spain);

The tomb of Marcus Venerius Secundio was discovered in 2021 during the excavations of the Porta Sarno necropolis in Pompeii. The tomb's inscription shows that the defunct was a former public slave who after his manumission rose to the rank of Augustales. The text also mentions that he was "custodian" of the temple of Venus, as well as the fact that he organized Greek and Latin performances. The particularity of the tomb is related to the inhumed and partially mummified remains of Secundio, a practice that was unusual among adults during the first century CE, being cremation the common funeral rite.
Inside hermetically sealed tomb chamber, the remains of a male over 60 years old were found. Although several traumatic injuries on the right side of the body were identified. Secundio clearly got an excellent care allowing him to successfully recover his health. Despite having been enslaved, no signs of biomechanical stress were found.
Hair and left ear tissues were preserved and the body was covered by an organic substance. It seems that this shroud over the body, along with the anaerobic environment caused by the sealing of the tomb, enhanced the mummification of the cadaver.
This presentation explains why Secundio was inhumed and partially mummified instead of being cremated. However further analytical studies will obtain more information and develop hypotheses about the mummified processes that took actions during the burial of this important personage of Pompeian society.

CORRESPONDENCE TO: **llor.alapont@gmail.com**

A 53

Anthropogenic mummification at Koshtamna, Nubia; the evidence from Douglas Derry's archives

Metcalfe, Jenefer (School of Biological Sciences, University of Manchester, Manchester, United Kingdom);

During the 1908-09 season of the first Archaeological Survey of Nubia, a series of rock-cut tombs dating to the Meroitic/Ptolemaic-Roman period were excavated at Koshtamna. Whilst few of the tombs were found intact, many still contained human remains including several anthropogenic mummies. The only publication of this excavation (Firth 1912) preserves some photographs of a few of the mummies found but little further detail. A number of recently discovered archival documents and photographs belonging to the anatomist on site during the excavation, Douglas Derry, provide further detail of the burials discovered and details of the mummification methods used to preserve them.
This presentation will provide an overview of the anthropogenic mummification methods employed at Koshtamna and the extent to which Egyptian and Nubian burial traditions appeared alongside one another at this site. The importance of the archival documentation will be explored, considering factors such as the age of the excavation and the racial and colonialist bias observed in many of these early anatomical studies. Whilst these can present a number of challenges to researchers today, the information preserved adds significantly to our understanding of mummification practises in ancient Nubia, especially given that the location of the majority of these mummies is now unknown.

CORRESPONDENCE TO: **jenefer.metcalfe@manchester.ac.uk**

A 54

Unusual artificial mummification in Medieval Italy: The Blesseds Illuminata and Chiarella from Montefalco (Perugia, Italy)

Lunardini, Agata (Department of Civilization and Forms of Knowledge, University of Pisa, Pisa, Italy); Giuffra, Valentina (Division of Paleopathology, University of Pisa, Pisa, Italy); Simonaitis, Lara (Division of Paleopathology, University of Pisa, Pisa, Italy); Gambini, Marcello (Division of Paleopathology, University of Pisa, Pisa, Italy); Minozzi, Simona (Division of Paleopathology, University of Pisa, Pisa, Italy);

In November 2021 the canonical recognition of the Blesseds Illuminata and Chiarella, exposed in the church of Saint Augustine in Montefalco (Perugia, Italy) was carried out. As Augustinian nuns and followers of Santa Chiara della Croce (1268-1308), they were named the Blesseds Chiarelle. A multidisciplinary study including historical, anthropological, radiological, histological, and paleopathological analysis, along with radiocarbon dating was performed. The body of Chiarella was mummified, but some districts were skeletonized, whereas Illuminata was completely skeletonized. The skulls showed evidence of craniotomy performed on the occipital and parietal region with fracture of the bone, while the spine, excluding the cervical tract, and the sacrum showed a sagittal opening. The analysis of the bones permitted to determine the type of instrument used to cut the vertebrae and the direction of the blows. A large aperture was left open along the cut, both at the level of the bones and the skin, possibly with the aim to leave an opening after evisceration to favour the drainage of the decomposition fluids. In the back of the Blessed Chiarella the presence of stitches along the margins of the cut could be explained with the application of a piece of fabric to close the opening and to maintain the filling of the body cavities. Inside the skulls and the thorax of Blessed Chiarella different filling materials, mainly represented by heterogeneous fabrics, were found. The artificial mummification process observed on the Blesseds Chiarelle appears unusual and is not historically documented.

CORRESPONDENCE TO: **agata.lunardini@libero.it**

SESSION 10:

Biomolecular studies

A 55

Mummification Modelling: Profiling the biomolecular mechanisms and markers of tissue degradation for archaeological and forensic applications

Sharpen, Jack (Division of Cell Matrix Biology and Regenerative Medicine; Facutly of Biology, Medicine and Health, University of Manchester Manchester, United Kingdom); Boggi, Byron (Division of Cell Matrix Biology and Regenerative Medicine; Facutly of Biology, Medicine and Health, University of Manchester Manchester, United Kingdom); Drosou, Konstantina (Division of Cell Matrix Biology and Regenerative Medicine; Facutly of Biology, Medicine and Health, University of Manchester Manchester, United Kingdom);

Understanding how biomolecules such as proteins, DNA, and lipids degrade is an important source of academic inquiry. The underlying mechanisms behind degradation are vital in the multidisciplinary field of taphonomy, including within both a forensic and archaeological context, and yet are still relatively unknown on a molecular scale despite advances in recent DNA research. Therefore, uncovering the processes and patterns behind degradation can provide an array of fresh insights into this field, including tissue biomarkers for post-mortem interval. To achieve this, a novel porcine micro-model was designed: pig tissue from the epidermal, dermal and hypodermal layers are subjected to conditions replicating post-mortem diagenesis over a series of time points, before being extracted for analysis using modern omics technologies. Here, a new integrated omics method was used to extract degrading proteome, genome, lipidome and metabolome concurrently, with the aim to minimise destruction of samples, before carrying out molecular biology investigations and downstream bioinformatics. Preliminary results were successful in comparing alterations seen in the post-mortem proteome, which involved identifying prospective diagenetic biomarkers across different time points, where a change in intracellular and extracellular post-mortem modifications could characterise different rates of tissue degradation. These exciting new methods also provide a simpler tool for studying in-lab forensic taphonomy, whilst trial modelling on spontaneous and anthropogenic mummified pig tissues has identified its potential in Egyptology. Combining these areas of investigation can forward the progress on unwrapping age-old questions behind how the mechanisms of tissue preservation occur.

CORRESPONDENCE TO: **jack.sharpen@manchester.ac.uk**

A 56

Mercury and mummies

López-Costas, Olalla (EcoPast, Cretus, Area of Archaeology, Department of History, Universidade de Santiago de Compostela, Santiago de Compostela, Spain; Department of Archaeology and Classic Studies, Stockholm University, Stockholm, Sweden); Colmenares-Prado, Marta (CRETUS, EcoPast, Area of Archaeology, Department of History, Faculty of Biology, Campus Vida, Universidade de Santiago de Compostela, Spain); Álvarez-Fernández, Noemi (CRETUS, EcoPast, Faculty of Biology, Campus Vida, Universidade de Santiago de Compostela, Santiago de Compostela, Spain; Boscalia Technologies S.L., Santiago de Compostela, Spain); Pokutta, Dalia A. (Department Archaeology and Classical Studies, Stockholm University, Stockholm, Sweden; Department Archaeology and Museology, Masaryk University, Brno, Czech Republic, Sweden); Martínez Cortizas, Antonio (CRETUS, EcoPast, Faculty of Biology, Campus Vida, Universidade de Santiago de Compostela, Santiago de Compostela, Spain);

Mercury is a metal, global pollutant used by humans since the Chalcolithic. Environmental pollution and cultural use cause mercury incorporation into human tissues. Mercury and compounds with high mercury content, e.g., cinnabar, were also used as post-mortem decoration, as well as in medical treatments and cosmetics. Although the target organs are kidneys and liver, there is still debate about its distribution in human body, and its bioaccumulation.
Mercury toxic nature was well-known in Antiquity, but also its biocide action. Romanised Egyptian culture had easy access to cinnabar. We hypothesize that small quantities of mercury could have been added to dead bodies´ skin, bandages, or balms to inhibit bacterial attack aiding embalming process. Roman Egyptian people could have also incorporated mercury through environmental exposure or direct contact. To explore this hypothesis, we analysed different tissues in a collection of Ptolemaic-Roman mummies curated in the Anthropology Department of the University of Wrocław (Poland). We collected 44 samples from 15 mummies and covering different layers, ranging from the external balm to the bone. We discover a wide variation among individuals but a constant gradient of increasing mercury content both from the external and inner layers towards the skin. In previous investigations in human skeletons, we found post-mortem incorporation of mercury into bone tissues, most likely due to its release from target organs during body decomposition; being a secondary source of mercury apart from premortem acquisition. Finally, we discuss mercury pre-mortem incorporation and the role of mercury in embalming processes.

CORRESPONDENCE TO: **olalla.lopez@usc.es**

A 57

Viral infections in a 16th century Italian infant mummy: a paleo-molecular biology study

Gaeta, Raffaele (Division of Paleopathology, Department of Translational Research, University of Pisa, Pisa, Italy); Spezia, Pietro (Department of Translational Research and New Technologies in Medicine and Surgery, University of Pisa, Pisa, Italy); Pistello, Mauro (Division of Virology, Dept of Translational Research and New Technologies in Medicine and Surgery, University of Pisa, Pisa, Italy); Giuffra, Valentina (Division of Paleopathology, Department of Translational Research, University of Pisa, Pisa, Italy); Poinar, Hendrik (McMaster Ancient DNA Centre, Department of Anthropology, McMaster University, Sidney, Canada); Fornaciari, Gino (Division of Paleopathology, University of Pisa, Pisa, Italy; Maria Luisa di Borbone Academy, Viareggio, Lucca, Italy);

The mummified remains of an unidentified child mummy, approximately 2-2.5 years of age, deceased in the second half of the 16th century and buried in the sacristy of the Basilica of Saint Domenico Maggiore in Naples (Italy), were exhumed between 1983 and 1986.
The macroscopic study revealed a diffuse vesiculo-pustular rash on the arm, body and face interpreted as a possible smallpox infection rash. Electron microscopic images showed egg-shaped, dense structures, and the positive results in immunostaining with protein-A/gold complex of sections of pustular skin incubated with human anti-vaccinia-virus antiserum corroborated the occurrence of the poxvirus.
Recently, the sequencing of ancient DNA extracted from bone and skin samples did not recover any reads belonging to the Variola virus, whereas many hepatitis B virus reads were identified. The phylogenetic analysis reveals that the HBV sequence belonged to a sub-genotype still common in the Mediterranean basin, and that the strain has not undergone significant mutations.
In addition, TEM analysis discovered particles consistent with an unknown large virus (300-400 nm); the considerable improvement in bioinformatic methodologies for the identification of viral sequences suggest the possibility that reads belonging to other viral families or genera belonging to the Poxviridae family can be identified (e.g. Monkeypox or Molluscipox virus). Given these analyses, a novel interpretation of the skin rash, with new hypotheses and differential diagnosis must be provided.
Recent developments in paleo-molecular biology are proving to be crucial for investigating past viral diseases and understanding their evolution.

CORRESPONDENCE TO: **raffaele.gaeta@med.unipi.it**

A 58

What mummies can reveal us about genetic diseases

Currò, Aurora (Clinical Genetics Service and South Tyrol Coordination Center for Rare Diseases, Regional Hospital of Bolzano, Bolzano, Italy); Inzana, Francesca (Clinical Genetics Service and South Tyrol Coordination Center for Rare Diseases, Regional Hospital of Bolzano, Bolzano, Italy); Stanzial, Franco (Clinical Genetics Service and South Tyrol Coordination Center for Rare Diseases, Regional Hospital of Bolzano, Bolzano, Italy); Wischmeijer, Anita (Clinical Genetics Service and South Tyrol Coordination Center for Rare Diseases, Regional Hospital of Bolzano, Bolzano, Italy); Benedicenti, Francesco (Clinical Genetics Service and South Tyrol Coordination Center for Rare Diseases, Regional Hospital of Bolzano, Bolzano, Italy);

Both the phenotypes and the causing defects of human genetic diseases are highly heterogeneous: identifying specific signs helps clinicians making hypotheses and reaching clinical diagnoses, which may be sometimes confirmed by molecular tests. Within paleopathology, finding specific traits of genetic syndromes in human mummies reveals important aspects about the history of genetic diseases throughout centuries. Since skin and bone are the best preserved tissues of human mummies, the genetic disorders mainly characterized by cutaneous and/or skeletal signs are the most recognizable: it's therefore not surprising that diseases such as neurofibromatosis type 1, Gorlin-Goltz syndrome and osteogenesis imperfecta are among the few diagnosed in mummified bodies. Thanks to the common practice of mummification in ancient Egypt, the majority of genetic diseases have been diagnosed on Egyptian mummies. Tutankhamun's and his family's mummies are undoubtedly the most studied: several hypotheses have been made about the genetic pathologies that could have affected some members of the pharaoh's family: Marfan, Loeys-Dietz and Klinefelter syndromes are just examples based on clinical evaluations. Unfortunately, the difficulties in analyzing DNA from ancient mummies make reaching a molecular diagnosis a hard challenge: to the best of our knowledge, familial adenomatous polyposis and Pompe disease represent the only two molecular genetic diagnoses made on human mummies. Thus, highlighting specific physical and radiological signs and, when possible, conducting molecular analyses can provide crucial information about genetic disorders in ancient mummies. In this review we report on the diagnoses of genetic diseases which have been made or suspected in human mummies.

CORRESPONDENCE TO: **aurora.curro@sabes.it**

A 59

The multimodal chemical and histological study of the Andean pre-Columbian Chancay mummies

Majchrzak, Lukasz (Indipendent Researcher, Ostrowek Kolonia, Poland); van Dalen Luna, Pieter (Escuela de Arqueologia, Universidad Nacional Mayor de San Marcos, Lima, Peru); Malek, Kamilla (Faculty of Chemistry, Jagiellonian University, Kraków, Poland); Kuncewicz, Joanna (Faculty of Chemistry, Jagiellonian University, Kraków, Poland); Miskowiec, Pawel (Faculty of Chemistry, Jagiellonian University, Kraków, Poland); Piprek, Rafal (Institute of Zoology, Jagiellonian University, Kraków, Poland);

During the archaeological excavations conducted by Pieter van Dalen on the Cerro Colorado site in the Peruvian Huaura Valley, more than a 1700 graves were discovered, many of them containing mummified human remains wrapped in funerary bundles. The cemetery is located on the Pacific desert coast and was used by the society of the poorly known Chancay culture (ca. 900 – 1578 AD). The results of the van Dalen's project allowed, for the first time, to analyse mummies from this region. Macroscopic study revealed there were no incisions which could suggest the intentional organ removal. Then, chemical and histological study of the skin was conducted. It included SEM – EDX, FTIR – ATR and HPLC – MS, with aim to reconstruct how and in which moment the soft tissue decomposition stopped. The results showed that in most cases some form of balm composed of animal fat, clay minerals, cinnabar and aromatic substances was present, although the skin decomposition was advanced, with little or no anatomical structures preserved. The use of anti – decay substances was confirmed then, and their presence possibly enhanced the preservation of the soft tissues. However, results of the funerary bundles analysis, and the information about Andean funerary patterns recorded in early colonial documents, raise the question whether the intentional mummification of their dead was in fact an interest of the Chancay people.

CORRESPONDENCE TO: **simbamakaton1@gmail.com**

A 60

The mummies of the Basilica of Saint Domenico Maggiore in Naples (XV-XVII centuries): a paleotoxicological approach

Fornaciari, Antonio (Division of Paleopathology, Department of Translational Research, University of Pisa, Pisa, Italy); Giuffra, Valentina (Dipartimento di Ricerca Traslazionale e delle Nuove Tecnologie in Medicina e Chirurgia, Università di Pisa, Pisa, Italy); Chericoni, Silvio (Department of Surgical, Medical, Molecular, Pathology and Critical Care, Università di Pisa, Pisa, Italy); Stefanelli, Fabio (Forensic Toxicology Laboratory, Department of Surgical, Medical, Molecular, Pathology and Critical Care, Università di Pisa, Pisa, Italy); Gaeta, Raffaele (Divisione di Paleopatologia, Università di Pisa Pisa, Italy); Fornaciari, Gino (Maria Luisa di Borbone Academy, Viareggio, Lucca, Italy);

In this contribution, we present and discuss two paleotoxicological studies by atomic absorption spectroscopy (AAS) on the mummified remains of the members of Aragon and vice-royal court of Naples, buried in the Neapolitan Basilica of Saint Domenico Maggiore (15–17th centuries).
In the first study, we performed a toxicological analysis of the hair content of fourteen mummified individuals: four mummies showed external perimortem application, three had no traces of mercury, and seven showed mercury values in hair ranging from 411 to 47 ppm, which indicated prolonged exposure in life to the metal. The historical identification of the bodies and the consequent nosography reconstruction, together with the direct paleopathological study of mummies, allowed us to assume that the prolonged exposure in life to the metal was probably due to mercurial anti-syphilitic therapy.
The second study was conducted on the colon samples of the natural mummy of Luigi Carafa, prince of Stigliano (1511-1576), affected by a stage III invasive adenocarcinoma of the colon.
The very high toxic levels of lead (50 ppm) and copper (53.5 ppm) demonstrate that the prince had been subjected in life to an iatrochemical-Paracelsian therapy with a high content of these metals.
Paleotoxicology is therefore an important resource in studies on mummified remains as, together with accurate paleopathological and nosographic diagnoses, it can help to obtain new information on past therapeutic practices.

CORRESPONDENCE TO: **antonio.fornaciari@unipi.it**

SESSION 11:

Mummification Methods

A 61

Rehydration recipes and pre analytical choices as a personalized medicine in histopathology of mummified tissues

Rossetti, Chiara (Department of Medicine and Surgery, University of Insubria, Varese, Italy); Fulcheri, Ezio (Division of Anatomic Pathology, Department of Surgical and Diagnostic Sciences (DISC), University of Genoa, Genoa, Italy; UNESCO Chair in Anthropology of Health. Biosphere and Healing systems); Boano, Rosa (Department of Life Sciences and Biology of Burial Systems, University of Turin, Turin, Italy);

In histological examination of mummified tissues, a critical aspect is the rehydration of the samples before the paraffin inclusion. The mummified tissues, properly rehydrated, preserve histological and morphological features as in fresh tissues samples, albeit with great variability among cases. Over the years, from 1852, several rehydrating hydro-alcoholic solutions have been reported in the literature, including formaldehyde, human serum and fabric softener; among these, the Sandison method (1955) is universally appreciated.
In modern times, a modified rehydration system is being developed: the best histological preparation can only be obtained with a careful choice of the rehydrating techniques, optimizing the rehydration times, or modifying the substances employed, according to the characteristics due to the different type of mummification.
In cases of natural mummification, Sandison technique allows to obtain excellent results with the only variation of the rehydration times.
Otherwise, in artificial mummification, the use of balms can cause partial tissue fixation; therefore, the rehydration with other substances with fixing power can be considered excessive.
Also, in cases of mummification using salt (natron), rehydration must not contain fixative substances so as not to further constrict tissues.
In both these types of mummification, the use of moisturizers has given excellent results in these cases.
In mummification with bitumen, rehydration must be preceded by the removal of bituminous substances, which prevent the penetration of liquids.
Furthermore, Gorini's petrification technique requires only direct inclusion in epoxydic resin.
This method could be also useful in the study of different types of mummification, both natural and artificial.

CORRESPONDENCE TO: **chiararossetti19@gmail.com**

A 62

Multiproxy biogeochemical approach of Egyptian mummies balm composition

Colmenares Prado, Marta (CRETUS, EcoPast, Area of Archaeology Department of History, Universidade de Santiago de Compostela, Santiago de Compostelal, Spain), Martínez Cortizas, Antonio (CRETUS, EcoPast, Faculty of Biology, Universidade de Santiago de Compostela, Santiago de Compostela, Spain); Kaal, Joeri (Pyrolyscience, Pyrolyscience, Santiago de Compostela, Spain); Pokutta, Dalia A. (Department of Archaeology and Classical Studies, Stockholm University, Stockholm, Sweden); López Costas, Olalla (CRETUS, EcoPast, Area of Archaeology Department of History, Universidade de Santiago de Compostela, Santiago de Compostela, Spain);

Embalming was a key step in the mummification process in Ancient Egypt. Although contemporary ancient texts describing these practices exist, it is still difficult to determine which specific substances were used. Uncertainty remains as to what extent these texts were based on actual knowledge on practical embalming processes or a theoretical interpretation of high-class mummification. Biochemical approaches can shed light into the quality and quantity of the components used for embalming. Here, we employ FTIR-ATR, Py-GC/MS and ICP-MS to balms of eight Ptolemaic-Roman mummies curated in the Anthropology Department of the University of Wrocław (Poland). We aimed to assess the components of the balms recipes and ascertain the differences between individuals. We found compounds compatible with Pinaceae resin (dehydroabietic acid derivatives from Py-GC-MS), and IR absorbances at 1735, 2850, 2929 cm-1, proteinaceous content (skin from the mummies), bone (602, 874, 965, 1032 cm-1), bitumen (cholestanes, steranes), probably beeswax (alkanes), and silicates (779, 1053 cm-1), as well as some metals (e.g. Pb, Ni, Cr, Cu). The balms´ compositional features were roughly alike, albeit with interesting differences. Our results agree with previous literature based on more destructive techniques. However, the presence of milled bone has been described only once, and we preliminary interpret it as desiccating agent. Silicates (e.g., quartz) can be related to deliberate use of sand or occasional adhesion of soil dust. The adopted multidisciplinary approach seems promising for understanding balm composition both for small and large datasets.

CORRESPONDENCE TO: **martapurificacion.colmenares@rai.usc.es**

A 63

The mummified people from Thebes, Egypt

Vandenbeusch, Marie (Department of Egypt and Sudan, British Museum, London, United Kingdom);
Antoine, Daniel (Department of Egypt and Sudan, British Museum, London, United Kingdom);

Thebes has a long and complex history, at times a capital, the centre of one of the most powerful temples of the ancient world or the place of burial of some of the most famous kings. From the eighty mummified individuals from ancient Egypt now at the British Museum, more than thirty are believed to have been buried in the Theban necropolis and its sacred lands. These individuals would have died between the New Kingdom (about 1300 BC) and the Roman times (2nd-3rd century AD). Over the centuries, the funerary and embalming practices evolved and changed. This paper will look at the techniques employed in the region and, by using new CT scans of the mummified remains curated at the British Museum, combines Egyptological and bioarcheological techniques to gain a better understanding of the mummification techniques used in this region over time, as well as the individuals being mummified.

CORRESPONDENCE TO: **mvandenbeusch@britishmuseum.org**

A 64

The multifaceted nature of Egyptian mummification: New insights into child mummies

Zesch, Stephanie (German Mummy Project, Reiss-Engelhorn-Museen, Mannheim, Germany); Panzer, Stephanie (Department of Radiology, Trauma Center Murnau, Murnau, Germany); Paladin, Alice (Institute for Mummy Studies, Eurac Research, Bolzano, Italy); Sutherland, M. Linda (MemorialCare Health Systems, Fountain Valley, U.S.A.); Lindauer, Susanne (Curt-Engelhorn-Centre Archaeometry gGmbH, Mannheim, Germany); Friedrich, Ronny (Curt-Engelhorn-Centre Archaeometry gGmbH, Mannheim, Germany); Helmbold-Doyé, Jana (Egyptian Museum and Papyrus Collection, Berlin State Museums, Berlin, Germany); Pommerening, Tanja (Institute for the History of Pharmacy and Medicine, Marburg University, Marburg, Germany); Zink, Albert (Institute for Mummy Studies, Eurac Research, Bolzano, Italy); Rosendahl, Wilfried (German Mummy Project, Reiss-Engelhorn-Museen, Mannheim, Germany);

An important basis of ancient Egyptian beliefs and rituals concerning the afterlife was the desire for a continuing existence in the afterlife, for which the body had to be preserved.
This study included 21 child mummies that were investigated by using radiocarbon dating, computed tomography and physical anthropology in order to reveal the time since death, age-at-death, sex, radiological evidence of individual wrapped limbs as well as the use of embalming substances, excerebration, evisceration, and the composition of packing materials (e.g. granular, resinous, textile). A radiological checklist and scoring system was applied for the first time on Egyptian child mummies in order to assess soft tissue preservation.
The samples included males and females ranging in age from neonate to 14 years, mostly originating from the Graeco-Roman Period. Twenty mummies revealed various macroscopic and radiological evidences indicating the use of embalming substances on the skin, such as dark-coloured areas (n = 7), resinous substances (n = 9), and granular components (n = 14). Differences concerning the wrapping techniques, embalming procedure, and the removal of brain and intestines were identified between individuals from Thebes-West and the Fayoum Oasis. Torso packaging with various materials was observed in all eviscerated mummies. The radiologically assessed soft tissue preservation scores ranged from 24.0 to 145.5 per individual (possible maximum score is 200).
The study provides detailed insights into the variety of mummification methods applied to bodies of subadults and demonstrates the benefit of child mummies as valuable bioarchaeological archives to explore past societies.

CORRESPONDENCE TO: **Stephanie.Zesch@mannheim.de**

A 65

The Ptolemaic Period. Pinnacle of Egyptian Mummification Technique?

Loynes, Robert (Department, University of Manchester, Middleton Stoney, United Kingdom)

Although some authors regard the New Kingdom as the golden age of mummification and therefore a reference point for the subject, there is little doubt that during the Ptolemaic Period the techniques and materials used for non-royal individuals became more complex and sophisticated. This is true of all aspects of the mummification process including the choice of excerebration and evisceration routes, the use of Canopic (visceral) packages for the return of embalmed viscera, treatment of the eyes and, in particular, the use of packing material inserted into the cranial and body cavities.
In order to attempt to put these practices into context a comparison is made with similar subdivisions of the mummification process used in the eras both before and after the Ptolemaic Period. As the Late, Ptolemaic and Roman Periods all reflect eras of the conquest and foreign rule of Egypt these comparisons will be considered as they may throw a light on the relationships between conqueror and conquered, particularly with regard to religion and religious freedom and practices as reflected by the embalming techniques used to preserve the body of the deceased for use in the afterlife.

CORRESPONDENCE TO: **robert.loynes@manchester.ac.uk**

A 66

Insights to Mummification Methods from Theban Tombs (TT) 65–67 in the Sheikh Abd el-Qurna Section of the Theban Necropolis at Luxor, Egypt

Stark, Robert James (Polish Centre of Mediterranean Archaeology, University of Warsaw, Warszawa, Poland); Bács, Tamás (Department of Egyptology, Institute of Ancient Studies, Eötvös Loránd University, Budapest, Hungary);

As part of the Hungarian Archaeological Mission in Thebes, Theban Tomb (TT) 65 Project, a series of mummified and skeletonised human remains of individuals recovered from contexts associated with the tombs of Imiseba/Nebamun (TT65), Hepu (TT66), Hapuseneb (TT67) and a Saff-tomb, identified as Saff-tomb 1, were examined over several field seasons. These tombs are situated in close proximity to one another in the Sheikh Abd el-Qurna section of the Theban Necropolis, located a short distance from the Deir el-Bahari temple of Hatshepsut, across the Nile river from Luxor, Egypt. This presentation focuses on the methods of mummification utilised across multiple periods, primarily New Kingdom and Third Intermediate Period contexts, among the human remains documented as part of the TT65 project and seeks to present a number of insights to less frequently documented practices, such as the insertion of palm ribs into the spinal canal.

CORRESPONDENCE TO: **r.stark@uw.edu.pl**

SESSION 12:

Museums & Collections

A 67

Celebrating the centenary of Arthur Aufderheide's birth (1922-2022)

Piombino-Mascali, Dario (Department of Anatomy, Histology, and Anthropology, Institute of Biomedical Sciences, Vilnius University, Vilnius, Lithuania); Nystrom, Kenneth (Department of Anthropology, SUNY, New Paltz, U.S.A.); Buikstra, Jane (School of Human Evolution and Social Change, ASU, Tempe, U.S.A.);

This year marks the century since the birth of prominent paleopathologist and mummy specialist Dr Arthur Aufderheide, whose role was vital in the development of modern mummy science. Aufderheide was a medical doctor who in the 1970s started pursuing a career in the study of ancient disease. An author of four books and over 100 scientific papers, he also contributed to the establishment of the World Committee of Mummy Studies. Hence, this symposium will be dedicated to his figure, to his numerous achievements, and to his legacy. Scholars from different continents will gather and commemorate Art and his wife Mary, his contribution to paleoepidemiology, as well as his mentorship towards early career researchers.

CORRESPONDENCE TO: **dario.piombino@mf.vu.lt**

A 68

Application of Modern Technologies to the study of Egyptian Mummies: the case of "Ankhekhonsu" of the Civic Archaeological Museum of Bergamo, Italy

Malgora, Sabina (Director Mummy Project, Italy); Milani, Chantal (Dipartimento di Scienze anatomiche, istologiche, medico-legali e dell'apparato locomotore, University "La Sapienza" of Rome; Mummy Project, Rome, Italy); Motta, Francesca (Mummy Project, Italy); Elias, Jonathan (Akhmim Mummy Studies Consortium, Carlisle, PA, U.S.A.); Carrafiello, Gianpaolo (Complex Operativ Unit, Policlinico Umberto I Hospital, Milan, Italy); Nicola, Marco (Adamantio - Science in Conservation s.r.l., Turin, Italy); Soggiu, Alessio (Department of Biomedical, Surgical and Dental Sciences, DSBCO University of Milan, Milano, Italy); Bonizzi, Luigi (Department of Biomedical, Surgical and Dental Sciences, University of Milan, Milan, Italy); Criminelli, Luca (Italy); Bulfoni, Alessandro (Obstetrics and Gynaecology Department at Humanitas, Pio X Hospital, Milan, Italy); Bernardo, Luca ((Department of Pediatrics, Fatebenefratelli Hospital, Milan, Italy); Casini, Stefania (Director of Civic Archaeological Museum of Bergamo, Italy); Scalarone, Dominique (Chemistry Department, University of Turin, Turin, Italy);

This work is the result of the project "A Mummy to be saved-2021", led by Mummy Project APS on the Egyptian Mummy of the Civic Archaeological Museum of Bergamo (Italy).
The mummy arrived in Italy in 1885 from Thebes inside a wooden coffin dated from the XXII Dynasty (900-800 b.C.), belonged to a priest of Amun named Ankhekhonsu, meaning "(The god) Khonsu is alive".
The aim of the project is to reconstruct the story of the individual, to confirm the originality of the owner of the coffin, underlining the importance of multidisciplinary analysis applied to the mummies using medical and forensic technologies: CT scan, endoscopy, chemical and physical analysis, studies on dentition, proteomics and genomics.
The mummy was first CT scanned, then underwent to an endoscopy using a Storz Medicals/ Carlo Bianchi Advanced Technologies video-broncoscope.
The CT scan allowed us to draw a complete biological and pathological profile of the individual; while endoscopy permitted us to observe directly what we learnt virtually through the CT scan and to collect samples. Both were useful to ascertain the peculiar condition of the body.
Following these practices, the collected samples has been moved to professional laboratories to undergo through the specific above-mentioned analysis.
The project was concluded with the restoration of the mummy and the creation of a digital 3D model of the facial reconstruction for the installation in the new museum that will open soon.

CORRESPONDENCE TO: **malgora.sabina@mummyproject.it**

A 69

The Bergamo mummy of Ankhekhonsu: Forensic Facial Reconstruction

Milani, Chantal (Dipartimento di Scienze anatomiche, istologiche, medico-legali e dell'apparato locomotore, University "La Sapienza" of Rome; Mummy Project, Rome, Italy); Malgora, Sabina (Director Mummy Project, Italy); Elias, Jonathan (Akhmim Mummy Studies Consortium, Carlisle, PA, U.S.A.); Motta, Francesca (Mummy Project, Italy); Casini, Stefania (Director of Civic Archaeological Museum of Bergamo, Italy); Carrafiello, Gianpaolo (Complex Operativ Unit, Policlinico Umberto I Hospital, Milan, Italy); Bulfoni, Alessandro (Obstetrics and Gynaecology Department at Humanitas, Pio X Hospital, Milan, Italy); Bernardo, Luca (Department of Pediatrics, Fatebenefratelli Hospital, Milan, Italy); Nicola, Marco (Adamantio - Science in Conservation s.r.l., Turin, Italy); Soggiu, Alessio (Department of Biomedical, Surgical and Dental Sciences, DSBCO University of Milan, Milano, Italy); Bonizzi, Luigi (Department of Biomedical, Surgical and Dental Sciences, University of Milan, Milan, Italy); Scalarone, Dominique (Chemistry Department, University of Turin, Turin, Italy);

The forensic facial reconstruction (FFR) is one of the final steps in the studies of a mummy and aims to offer a possible appearance of the individual hidden by the bandages. It is based on the principle that the skull, like most of the anatomical structures, presents strongly characterizing elements of the individual to which it belonged: the soft tissues will manifest a set of proportions, shapes and details of the underlying skull, which will also partially appear in the face that will emerge.
The reconstruction of the face requires a series of preliminary phases that have been also followed in the case of the Bergamo mummy: a Computed Tomography made it possible to virtually unwrap the mummy and obtain a virtual copy of the skull as well as the virtual autopsy necessary for the drafting of the anthropological profile on which the choice of suitable soft tissue thicknesses pegs is based. The anthropological analysis reveals that the remains are of a Caucasoid male who died between 40-50 years of age, with an average physical structure. The FFR was developed according with Manchester method in a 3D virtual environment. The techniques currently in use combine scientific methods with an inevitable subjective component of the operator, who is able to shape the subcutaneous plane up to the skin plane, following markers of known thickness, that are the result of extensive studies by several authors.

CORRESPONDENCE TO: **milanich@gmail.com**

A 70

Post-Medieval Mummies in the Church of Seili, Finland

Paasikivi, Sofia (Department of Archaeology, University of Turku, Turku, Finland); Moilanen, Ulla (Department of Cultures, University of Helsinki, Helsinki, Finland);

Most mummies in northern Europe are situated in churches or private burial chapels. Some of these mummies - including the ones at Seili church - have become famous among tourists and visitors. The island of Seili in the Southwestern Finnish archipelago is a unique site with a rich and interesting past as a leprosy hospital and a mental asylum between the 17th and early 20th centuries. According to historical records, the crypt of Seili church has been a burial place for seven individuals with a higher socioeconomic status in the rural island community. The archaeological research conducted in the crypt aimed to identify the buried individuals and their causes of death and study their overall health and the culture of death and burial in 18th century Finland. Comparisons between historical records and archaeological data reveal that the crypt has been reorganised during its use and that most of the women buried in the crypt were relocated elsewhere when new male burials were interred. Due to these reasons, it is difficult to identify the individuals. However, the identification would be important for the taphonomic study of the mummification processes and ensuring that the narratives about the crypt are based on historical facts.

CORRESPONDENCE TO: **skpaas@utu.fi**

A 71

Lost and Found: Mummies and Bones of the so-called Priest Tombs from the Mortuary Cult Complex of Ny-User-Ra in Abusir, Egypt

Teßmann, Barbara (Museum für Vor- und Frühgeschichte Berlin, Staatliche Museen Preußischer Kulturbesitz, Berlin, Germany);

During the excavations carried out by Ludwig Borchardt from 1902 onwards for the German-Oriental-Society in Abusir in the area of the funerary cult complex of King Ny-user-Ra from the 5th Dynasty (c. 2400 BC), the excavators came across burials, some of which were still undisturbed. These were mainly the graves of persons known by name who, as priests, were responsible for maintaining the funerary cult of the deceased ruler and are therefore summarised as "priest graves" in the publication by Heinrich Schäfer (1908). The archaeological material of the graves, some of which are still complete and found in situ, is today distributed among various collections in Europe. The graves are dated of the of the grave goods, stylistic-criteria and linguistic-historical indications, to the transitional period from the Old Kingdom via the 1st Intermediate Period to the Middle-Kingdom. In addition to a large part of the archaeological finds, several mummies were also brought to Berlin, but for a long time they were considered war losses. During the reassembly of the S-skull-collection in the Museum of Pre- and Early-History in Berlin, these skeletons were recently found again and have since been subjected to renewed scientific evaluation. In addition to the anthropological examination, in which the individual-data (age, sex, body height) as well as pathological features are recorded, the skulls of the individuals are also x-rayed in order to better assess possible mummification techniques. In addition, DNA-analyses and C14-dating are carried out in cooperation with the Max Planck Institute for Evolutionary Anthropology.

CORRESPONDENCE TO: **barbaratessmann@gmx.de**

SESSION 13:

Museums & Conservation

A 72

The other face of musealization: 3D computerized reconstruction of the facial features of an Egyptian mummy

Manzollino, Roberta (Sapienza University of Rome, Rome, Italy); Rodella, Lucrezia (LABANOF – Laboratorio di Antropologia e Odontologia Forense, Università degli Studi di Milano, Milano, Italy); Del Vesco, Paolo (Museo Egizio, Fondazione Museo delle Antichità Egizie di Torino, Turin, Italy); Zink, Albert (Institute for Mummy Studies, Eurac Research, Bolzano, Italy); Conti, Viviana (Independent Forensic Virtual Anthropology Researcher, Italy); Paladin, Alice (Institute for Mummy Studies, Eurac Research, Bolzano, Italy);

Craniofacial reconstruction (CFR) -also known as facial approximation or representation - is a forensic technique used for the reconstruction of the ante mortem facial appearance of an individual starting from the skull. CFR techniques are employed in archaeological research to create portraits of people from the past. Moreover, the reconstruction of facial features offers the opportunity to expand the knowledge of the biological profile (age at death, sex, stature, paleopathologies).
In this study, the facial features of a mummy (Suppl.14396) exhibited at the Museo Egizio in Turin (Italy), were reconstructed using computerized tomography (CT-scan) from the mummified cranium, following the combination Manchester method in a virtual environment. This mummy was found together with some grave goods (e.g., linen cloths. headrest, a clay jar, mirror), during an excavation campaign in Asyut (Egypt), under the direction of Ernesto Schiaparelli (1911-1913). The individual, dated to the Old kingdom (14C), was a mature woman, showing several dental pathologies (e.g., periodontitis, abscess) and signs of trauma on the right parietal bone of the cranium.

CORRESPONDENCE TO: **roberta.manzollino@uniroma1.it**

A 73

Digital fabrication and heritage enhancement: the Pavia mummy copy made by Spazio Geco Fab Lab

Belvedere, Marianna (Spazio Geco Società Cooperativa srl, Pavia, Italy); Tramontin, Marialetizia (Spazio Geco Società Cooperativa srl, Pavia, Italy);

The exposition of mummies in the museums has remained almost unchanged throughout the decades. While the preservation must be the top priority, the challenge is to make them more accessible to the public. In this case, we had an Egyptian mummy donated to the University of Pavia in 1842 directly from Cairo. Although unwrapped and without its original coffin, it appeared in a surprisingly good shape, but it was of a paramount importance to act fast. Thanks to the collaboration with the Mummy Project, the most modern medical and forensic investigation techniques were used to analyse the specimen, and it was established that it belong to a 20-year-old woman, who died in the third century BC. Restored the mummy and understood the better way to preserve it - within a special showcase and at a certain temperature and humidity - Spazio Geco went on with the project: the aim was to get her out of those four glasses to meet the public. It was hence decided to use a 3D portable scanner to create a digital model and with that to make a replica of the mummy itself using the slicing technique. To do so a combination of some of the most advanced technologies was used: 3D printers, large format 2d laser cuts and CNC milling machines. The result is a 1:1 reproduction of the mummy, which is daily touched by dozens of hands, and which offer a unique experience which is accessible to everyone.

CORRESPONDENCE TO: **marialetizia.tramontin01@universitadipavia.it**

A 74

The archeoParc Schnals museum and the environment of the Schnalstal valley

Schraut, Philipp (archeoParc Schnals Museumsverein, Senales, Italy)

The archeoParc Schnals is an open air museum in the middle of the Schnalstal valley in plain view of the recovery site of Ötzi the Iceman. While the Archeological Museum of Bolzano is concipated to preserve the Iceman and to display the mummy itself and the original artifacts that have been found together with the frozen body, the archeoParc museum is displaying reconstructions of the Neolithic gear.
The inside of the museum building is distributed on three floors that are interconnected, referring to the different levels of altitude in the mountain landscape. On the top level there is a 1:10 scale model of the place where Ötzi was found together with a screen that provides real time data of the temperatures, humidity and wind at the recovery site. The exceptional climate of the Schnalstal vally was the key in the natural mummification of the Iceman.
To get visitors familiar with Stone Age technologies, the biggest part of the museum is outdoors, where they can walk through reconstructed Neolithic houses from various sites around the Alps and learn hands-on easy tasks in Neolithic daily life.

CORRESPONDENCE TO: **oetzis.enkel@gmail.com**

A 75

A new exhibition room at the Museo Egizio: Between conservation and display of human remains

Barbero, Enrico (Fondazione Museo delle Antichità Egizie di Torino, Torino, Italy)

On June 24th 2021, a new exhibition room called 'In Search of Life - What Do Human Remains Tell?' was inaugurated at the Museo Egizio in Turin.
The museum houses a large collection of human remains, around 90 individuals, most of which are stored in the museum's deposits. The aim of the project was to create a highly technological repository with a specific humidity and climate-controlled environment adapted for human remains, that is used at the same time as exhibition room communicating the concept of life and death in ancient Egypt.
The new room is part of the inner core of the 17th century building, previously used as office space: in order to adapt the planned repository and display space to the already existing structure of the building a rather complex analysis was required,, reconciling the needs of conservation and display. In particular, the dampening effect of the external surfaces was far below the one of the historical walls of the building, because of the large stained-glass windows.

The best solution was to create a room within the room: a large showcase was built in the centre of the space, constructed as metal structure holding superimposed shelves, where the human remains are placed.
The new room was therefore designed specifically for the preservation of human remains, using high quality materials and up-to-date technology for that type of culture heritage.. In addition, by bringing all human remains together in one room, conservators and researchers have finally an adequate access to study the Turin collection.

CORRESPONDENCE TO: **enrico.barbero@museoegizio.it**

A 76

Chinchorro Transcend Death: The Usefulness Of CT Scan For The Construction Of Mummies Replicas To Museography

Silva-Pinto, Verónica (Anthropology, Museo Nacional de Historia Natural de Chile, Santiago, Chile); Valenzuela-Sánchez, Yanis (Anthropology, Museo Nacional de Historia Natural de Chile, Santiago, Chile); Tonko-Huenucoy, Ayelen (Anthropology, Museo Nacional de Historia Natural de Chile, Santiago, Chile); Montoya, Carlos (engineer, Freelance, Santiago, Chile); Galvez, Marcelo (Radiology, Clinica Las Condes, Santiago, Chile);

The exhibition of human bodies in museums and especially mummified bodies has always been a focus of attraction, due to the fact that it allows someone who lived hundreds and even thousands of years ago direct observation, causing fascination and solemnity, becoming for the museum visitor one of the most memorable experiences.
Although there is a tendency in Chile and other countries to not exhibit human bodies due to ethical and conservation considerations, this should not mean for museums, truncate areas of information about the past in relation to mortuary rites and the phenomenon of death itself. For this reason, it is necessary to make replicas that, more than being mere artistic reproductions, are able to transmit the same sensation of a real body.
The exhibition "Chinchorro Transcend Death" of the National Museum of Natural History of Chile, exhibits replicas of Chinchorro bodies (the oldest mummies in the world), created from computed tomography (SOMATON Definition AS, Siemens) performed on real bodies. In the post-processing with the software Autodesk 3DsMax, models were created that allow visualizing the interior, maintaining the morphology of the body surface. Then the 3D printing process was carried out in a Fortus 250mc de Stratasys (Fused Decomposition Model) and finally the bodies were reworked on by a visual artist, giving them texture, color and replacing plastic segments with animal and vegetable fibers, obtaining hyper-realistic replicas that have had an excellent reception from the public, who often wonders if they are real or not.

CORRESPONDENCE TO: **veronica.silva@mnhn.gob.cl**

A 77

Interdisciplinary Research on Andean Mummies at the Royal Museums of Art and History, Brussels, Belgium

Lemaitre, Serge (American collections, Royal Museums of Art and History, Brussels, Belgium); Tilleux, Caroline (American collections, Royal Museums of Art and History, Brussels, Belgium); Coche, Emmanuel (Service of radiology, Cliniques universitaires Saint Luc, Brussels, Belgium); Danse, Etienne (Service of radiology, Cliniques universitaires Saint Luc, Brussels, Belgium); Polet, Caroline (Earth Science, Royal Belgian Institute of Natural Sciences, Brussels, Belgium);

The Royal Museums of Art and History preserves, in the "Americas" section, seven mummified bodies or body parts. For several of them, material is associated in the form of ceramics but also wooden or textile objects. Three bodies are still surrounded by textiles in the form of funerary fardo. Four other bodies are naked but were probably also held up by ties and fabric. The project Interdisciplinary Research on Andean Mummies aims to study in depth these human remains. Arrived over the years 1840, through various donors, these mummies have reached us without any archaeological context, or even without a precise provenance. We therefore try to give an identity to each individual thanks to the associated archaeological material as well as by a detailed anthropological study. For the museum and Belgium, one of them, exhibited in the permanent collections, is very important and was the subject of a first study in the 1990s. This mummy was made famous thanks to the place of choice that Hergé reserved for it in two of his albums as Rascar Capac (The 7 crystal balls and The Temple of the Sun). During the first scan of this individual in 1998, interesting elements had already appeared, such as osteoarthritis, but recent advances in medical imaging make it possible to refine these initial findings and obtain better quality imaging and 3D modeling. These analyses were also applied on the other six mummies and we will present their original results.

CORRESPONDENCE TO: **serge.lemaitre@gmail.com**

SESSION 14:

Funerary Archaeology & Imaging

A 78

The Lord of Cajamarquilla: Analysis of the funerary context of the Cajamarquilla mummy from funerary archaeology

Huaman Santillan, Yomira Silvia (Universidad Nacional Mayor de San Marcos, Universidad Nacional Mayor de San Marcos, Lima, Peru)

The archaeological complex of Cajamarquilla is one of the largest pre-Hispanic cities found in the capital of Peru (Lima), which is located on the right bank of the middle Rímac valley and the Huaycoloro ravine. In the research work with archaeological excavation, a typology of tombs or complex funerary chambers was discovered. Associated with human burials with different traditions such as the coast and the high Andean mountains. In which we have recovered more than 30 individuals, including mummified bodies. The analysis of these individuals has allowed us to learn important details about the mummification process, but also about body modeling (cephalic modeling) and paleopathology (degenerative lesions, osteoarthritis, tuberculosis). X-ray analyzes and 3D tomography analyzes have been carried out to learn more about the burial process, characteristics and variations of the individual. From these paleopathological analyses, the characteristics of the funerary bundles or wrappings (composed of tissues and other associated materials) and the associated materials, it has been possible to determine the work activity of individuals, their social status and the importance they acquired. for society as "ancestor" or "mallqui", social protector of the living, to whom they constantly had to deliver offerings composed mostly of food and drinks; although also by sacrificed animals; being their textiles remodeled and carried periodically in procession by their descendants.

CORRESPONDENCE TO: **yomira.huaman@unmsm.edu.pe**

A 79

Archaeological studies on the mummies of the Chancay culture

van Dalen Luna, Pieter (Escuela de Arqueologia, Universidad Nacional Mayor de San Marcos, Lima, Peru)

The Chancay culture is a late pre-Hispanic society that developed on the north-central Peruvian coast between the Chancay and Huaura valleys. This society enabled extensive funerary areas in the corners of the valleys, in strategic places oriented towards the sacred mountains. The funerary practices of the Chancay culture were complex, from the elaboration of funerary structures to the treatment of individuals. In recent years we have carried out excavations in the funerary complexes of Macaton (Chancay Valley) and Cerro Colorado (Huaura Valley), where we have been able to recover the remains of more than 3,000 individuals, many of them mummified. The analysis of these individuals has allowed us to learn important details about the mummification process, but also about body modeling (head modeling, tattoos, etc.) and paleopathology (degenerative lesions, osteoarthritis, leishmaniasis, tuberculosis and cancer). Radiocarbon 14 analyzes have been carried out to determine the date of burial and the characteristics and temporal variations of each funerary pattern. From these paleopathological analyses, the characteristics of the funerary bundles or wrappings (composed of tissues and other associated materials) and the associated materials, it has been possible to determine the work activity of individuals, their social status and the importance they acquired. for society as "ancestor" or "mallqui", social protector of the living, to whom they constantly had to deliver offerings composed mostly of food and drinks; although also by sacrificed animals; being their textiles remodeled and carried periodically in procession by their descendants.

CORRESPONDENCE TO: **pvandalenl@unmsm.edu.pe**

A 80

Wait in the fire: cremation of mummies as a funeral rite in the pre-Wari period at the archaeological site of Minaspata in the Lucre Basin (Cusco-Peru)

Errera, David (Ministerio de Cultura – Perú, Cusco, Peru)

Cremation is an archaeologically unrecorded activity in the pre-Hispanic Andes. The few findings consist of offering chambers in which fragments of human and animal bones, ceramics, textiles, and malacological materials were burned together. The findings in Minaspata, an archaeological site 31 km from Cusco City between 2014 and 2016 and under the auspices of the University of Pennsylvania and the Peruvian Ministry of Culture, have shown a series of funerary practices not recorded until now. This is the cremation of mummies along with complementary practices such as the cutting of feet and beheadings, all as part of a possible simultaneous ritual of the cult of fire and ancestors. This finding was dated to before the arrival of the Wari culture, the first Andean Empire, to the study site. This means that the cremation of these mummies was progressive between 1,400 BCE and 550 CE, when Minaspata was abandoned. Ethnographic studies carried out demonstrate a relationship between these ancient cremations and the current burning of mummified fetuses and newborn camelids in ceremonial offerings to the Pachamama (Andean mother earth). In the same excavation season, evidence of the occupation of the Inca nobility was found, corroborating the writings of the early Spanish chroniclers in the Andes that the site was the birthplace and residence of Huáscar, the last Inca Governor. The discovery of two mortuary contexts, among them a Capacocha (sacrifice of a child), is evidence of the Inca Civil War (1529–1532) on the site.

CORRESPONDENCE TO: **bregmaerrera@gmail.com**

A 81

A new approach on the smell of Egyptian mummies: study of their odorous organic compounds

Timbart, Noelle (Département Restauration, Centre de recherche et de restauration des musées de France (C2RMF), France); Lattuati-Derieux, Agnès (Département recherche, Centre de recherche et de restauration des musées de France (C2RMF), Paris, France); Colson, Isabelle (Service des musées de France, Ministère de la culture, Paris, France); Nicolas, Mélanie (Centre scientifique et technique du bâtiment, France); Anton, Rukshala (Centre scientifique et technique du bâtiment, France); Thierion, Lise (France); Guichard, Hélène (Département des Antiquités égyptiennes, Musée du Louvre, Paris, France); Etienne, Marc (Département des Antiquités égyptiennes, Musée du Louvre, Paris, France); Remy, Juliette (Département conservation préventive, Centre de recherche et de restauration des musées de France (C2RMF), Paris, France); Devautour-Vinot, Sabine (UMR 5253 - CNRS/UM/ENSCM, Pôle Chimie Balard Recherche, Institut Charles Gerhardt Montpellier, Montpellier, France); Pires-Conti, Patrick (UMR 5253 - CNRS/UM/ENSCM, Institut Charles Gerhardt Montpellier, Montpellier, France); Dasgupta, Sanchari (Institut Lavoisier de Versailles, Versailles, France); Steunou, Nathalie (Institut Lavoisier de Versailles, Versailles, France); Moularat, Stéphane (Centre scientifique et technique du bâtiment, France);

Mummies emit specific smells and these Volatile Organic Compounds (VOCs), present in the indoor air, cause embarrassment both to the public and the museum staff when presented in museums or kept in storerooms. However, little research has been conducted to assess their potential toxicity and to determine whether these smells are related to the embalming materials or whether they reflect particular alteration phenomena. Indeed, Egyptians used various substances in mummification process through history and their natural degradation can explain, in part, their smells. In this context, we aimed to identify the most abundant VOCs emitted by three Egyptian mummies kept at the Musée du Louvre. The choice was based on their dating involving distinct mummification processes and smells which seem different.
VOCs were collected around mummies using Tenax TA adsorbents, a non-destructive sampling method. In parallel, a study was conducted to correlate the analytical results with historical knowledge of the materials used by the ancient Egyptians. A wide diversity of 148 VOCs (carbonyle compounds, hydrocarbons, aromatics, terpens...) were qualitatively and quantitatively identified by GC/MS after desorption. From those, 38 were emitted by all mummies and were therefore non-distinguishing whereas others were specific.This new methodological approach highlighted the importance of identifying odorous compounds for a better conservation and presentation of these specific collections. The next step will consist in developing a new type of adsorbent based on porous hybrid organic-inorganic materials such as Metal Organic Frameworks (MOFs), to capture the most predominant VOCs to strongly reduce their amount.

CORRESPONDENCE TO: **noelle.timbart@culture.gouv.fr**

A 82

Tiny bugs and mummies: a clever mix! Archaeoentomology, archaeoparasitology and 3D reconstruction

Kirgis, Pauline (UMR 5199 PACEA, De la Préhistoire à l'Actuel : Culture, Environnement et Anthropologie, University of Bordeaux, France, Pessac, France); Nelson, Andrew (Department of Anthropology, Western University, London, Ontario, Canada); Bou, Christophe (Training and Research Unit in Odontological Sciences, University of Bordeaux, Bordeaux, France); Gourgues, Jane (Training and Research Unit in Odontological Sciences, University of Bordeaux, Bordeaux, France); Watson, Lucia (Dirección de Humanidades Artes y Ciencias Sociales (HAS), Universidad de Ingeniería y Tecnología, Lima, Peru); Huchet, Jean-Bernard (UMR 5199 PACEA, De la Préhistoire à l'Actuel : Culture, Environnement et Anthropologie, University of Bordeaux; CNRS; MNHN, Bordeaux, France);

Funerary bundles of pre-Columbian America are frequently the hosts of many different insects and parasites that can act precious auxiliaries to get unprecedented data on the mummy itself and, more comprehensively, on past funerary practices. After defining the discipline known as "Funerary archaeoentomology", we will present a new working approach, using CT scan and 3D reconstruction of certain anatomical regions that may have been colonized by insects at the time of death or shortly after. This new study process reconstructs the mummy and the entomological material with the help of adapted filters. This non-invasive and non-destructive method respects the standards of museum conservation. Finally, we will present the first results of our research carried out within the framework of a PhD thesis, with as examples some of the 89 funerary bundles coming from the site of Pachacamac of the central coast of Peru which constitute our corpus of study.

CORRESPONDENCE TO: **pauline.kirgis@gmail.com**

A 83

Where eternity ends – a conservator's job begins

Krachler, Sophie (Department of Prehistory & Department of Anthropology, Natural History Museum Vienna, Vienna, Austria);

Conservation of the mummy collection of the Natural History Museum Vienna
Diploma Thesis 2021/2022
Mummies – the embodiment of eternal life. Withdrawn from decay and preserved for millennia, they are focus of unparalleled fascination and hold privileged positions in museum collections. Yet mummies are a current research topic in conservation science, because, like any other museum object, they are exposed to constant deterioration.
Deterioration is also, what threatened the mummy collection of the Natural History Museum (NHM) in Vienna. This collection, which includes 33 mummified human remains from various, mostly unknown provenances, is small but very diverse.
The collection was considered to be at risk of damage and loss, because of the old, inadequate storage concept. Therefore, the presented diploma thesis focused on the clarification of inventory and condition as well as the conceptualisation and implementation of a new storage concept.
Scientific literature about mummies is widely available in other scientific fields; however, issues in conservation science still represent a desideratum. Hence the conceptualisation of a new storage system represented a challenging task.
Based on expertise from conservators from Vienna, London and Bolzano, a new, more suitable storage concept was created. Finally, the mummy collection was documented photographically and descriptively and transferred into new opaque, acid free, metal-free storage-boxes. This ensured the conservation of intangible as well as tangible properties of the collection, allowing future scientists to handle and analyse the mummies with minimal direct contact.

CORRESPONDENCE TO: **sophie.k@kabsi.at**

SESSION 15:

Mummy Exhibition

A 84

The Bologna mummy project: an interdisciplinary approach to the study of human remains from Roman and Medieval Egypt

Picchi, Daniela (Egyptian Collection, Civic Archaeological Museum of Bologna, Bologna, Italy); Samadelli, Marco (Institute for Mummy Studies, Eurac Research, Bolzano, Italy); Golfieri, Rita (Dipartimento di Radiologia, IRCCS Azienda Ospedaliero-Universitaria di Bologna, Bologna, Italy); Vara, Giulio (Dipartimento di Radiologia, IRCCS Azienda Ospedaliero-Universitaria di Bologna, Bologna, Italy); Buscaglia, Paola (Centro Conservazione e Restauro "La Venaria Reale", Veneria Reale (Torino), Italy); Genta, Roberta (Centro Conservazione e Restauro "La Venaria Reale", Venaria Reale (Torino), Italy); Piccirillo, Anna (Centro Conservazione e Restauro "La Venaria Reale", Venaria Reale (Torino), Italy); Pozzi, Federica (Centro Conservazione e Restauro "La Venaria Reale", Venaria Reale (Torino), Italy); Cardinali, Michela (Centro Conservazione e Restauro "La Venaria Reale", Venaria Reale (Torino), Italy); Tomedi, Irene (Restauro e conservazione tessuti antichi, Bolzano, Italy); Wurst, Christina (Institute for Mummy Studies, Eurac Research, Bolzano, Italy); Maixner, Frank (Institute for Mummy Studies, Eurac Research, Bolzano, Italy); Zink, Albert (Institute for Mummy Studies, Eurac Research, Bolzano, Italy); Paladin, Alice (Institute for Mummy Studies, Eurac Research, Bolzano, Italy);

The Bologna mummy project (BOmp) is the result of the institutional collaboration between the Civic Archaeological Museum of Bologna and the Institute for Mummy Studies of Eurac Research, launched in 2019. The aim was to return two inedited Egyptian mummies to the scientific community and to the public: a female adult mummy with a rare painted shroud (1st-2nd century AD) and a male subadult mummy with three tunics (13th century AD). The mummies have been housed at the museum storerooms since the late 1970s. These human remains were temporarily retained in a conservation soft box (CSB), as they needed an urgent conservation treatment. This project required an interdisciplinary scientific approach to acquire the computed tomography (CT) scans of the bodies, to obtain the radiocarbon date (14C), to reconstruct the biological (e.g., anthropological and molecular sex, age at death) and the palaeopathological profiles, and to gain insight into the embalming techniques (including the VOCs emissions). Additionally, the mummies underwent two complex restoration interventions. In particular, the conservation treatment of the mummy with the painted shroud needed further multi-technique investigations (e.g., imaging, non- and micro-invasive spot analyses), including experimental research to evaluate the performance of innovative materials for conservation. The subadult mummy, which displayed the most critical conservation status, required greater attention to the preservation of the human remains, the mechanical cleaning of the textiles, and their restitution to the original shape. This project will be further developed and extended to include the study of other Egyptian mummies of the Bologna museum.

CORRESPONDENCE TO: **daniela.picchi@comune.bologna.it**

Poster

SESSION

P 01

Multidisciplinary study of a smoked mummy from Australia

Teßmann, Barbara (Museum für Vor- und Frühgeschichte Berlin, Staatliche Museen Preußischer Kulturbesitz, Berlin, Germany, Italy); Winkelmann, Andreas (Institut für Anatomie, Medizinische Hochschule Brandenburg, Neuruppin, Germany); Wurst, Christina (Institute for Mummy Studies; Eurac Research, Bolzano, Italy); Maixner, Frank (Institute for Mummy StudieS; Eurac Research, Bolzano, Italy); Zink, Albert (Institute for Mummy StudieS; Eurac Research, Bolzano, Italy);

The German anatomist and anthropologist Hermann Klaatsch acquired a smoked mummy under extremely dubious circumstances at the end of 1904 in North Queensland (Australia), which he sent to the BGAEU in Berlin. It is known from historical sources that these are the remains of "Ng:tja", also known as Barry Clarke. In 2014, there was a restitution request from the descendants to the BGAEU. The restitution took place on 3/20/2017. During the provenance research on these human remains, the descendants of "King Ng:tia" gave their consent for the remains to be examined both anthropologically and invasively. To our knowledge, this is the first detailed scientific study of an Australian mummy. With the help of CT images, the mummification could be reconstructed. The internal organs were most likely removed through the rectum, and then the abdominal cavity was filled with cloths so that the body would retain its shape. The mummy had the upper and lower extremities placed tightly against the body and then tied up, with the legs tied over the arms. The CT scans also showed typical bony changes on the skull and tibiae indicative of syphilis disease.
Genetic analysis confirmed the sex as male. Examination of the female genetic lineage revealed membership of mitochondrial haplogroup P, which is found in approximately 50% of Australian aborigines.

CORRESPONDENCE TO: **barbaratessmann@gmx.de**

P 02

Hidden behind the mask: CT scans of the Siberian mummy of Oglakhty provide insight into its head mummification and portrait likeness of the mask

Shirobokov, Ivan (Department of Anthropology, Museum of Anthropology and Ethnography named after Peter the Great, Kunstkamera, Saint-Petersburg, Russian Federation); Pankova, Svetlana (Department of Archaeology of Eastern Europe and Siberia, The State Hermitage Museum, Saint-Petersburg, Russian Federation); Kitova, Alexandra (Centre for Egyptological Studies of the Russian Academy of Sciences, Moscow, Russian Federation); Rasskazova, Anna (Research Institute and Museum of Anthropology named after D.N. Anuchin, Moscow State University, Moscow, Russian Federation);

Ancient population of the Minusinsk basin (Southern Siberia, 1–4 centuries CE) had complicated funeral rituals including trepanation of the sculls and applying plaster painted masks to the faces of the dead. Unfired masks were found on the faces of two desiccated mummies from Oglakhty cemetery, grave 4 along with a range of artifacts made from organic materials, which preserved thanks to special climatic conditions occurred in the grave pit. Masks can not be removed from the heads without destruction. Male head was subjected to the CT scanning followed by 3D modelling of the entire head, the scull and the mask.
It was revealed that the mummy belong to a person aged 25-30. His preserved face contains surgery seams which can be explained as a result of actions aimed at the slowing down the decomposition of soft tissues. Together with a trepanation hole they can be a sign of intentional mummification of the head, whereas no traces of deliberate mummification are preserved on the body.
Observations on the inner and outer surfaces of the mask enabled understanding of its portrait likeness with the man. His face turned out to be of much more distinctive West Eurasian appearance than his image on the mask, which has flatter horizontal facial profile. The results of cranial measurements of the 3D model showed that his skull is in turn different from the other Oglakhty people's skulls which are generally of stronger Eastern Eurasian features commonly depicted on the masks.

CORRESPONDENCE TO: **svpankova@gmail.com**

P 03

Ancient Mummies with Tattoos from South American Andes an Introduction

Gerst, Robin (Institut für Archäologische Wissenschaften Vor- und Frühgeschichte, Goethe Universität Frankfurt, OffenFrankfurtbach, Germany);

Almost everywhere in the world there are archaeological findings of mummies with permanent skin markings - tattoos. But in no other region of the world there are as many of them as in the Andean countries, in the territory of the former Inca Empire.
Until the arrival of the Europeans, tattooing seems to have been more common in this region; a tradition that may have lasted up to 4000 years. Mummified bodies with skin markings are found in a variety of societies and cultures: From itinerant groups to hierarchical urban communities. Despite some spectacular findings, we are still in the early stages of understanding the phenomenon of pre-Hispanic tattooed mummies. In a comparative approach of interdisciplinary mummy research, including ikonography, anthropological and archaeological findings, an introduction will be given for the broad topic of this type of permanent body modifications in ancient Andean societies. Historical records from the colonial period and recent ethnological studies are also taken into account.
A total of over 100 mummies and mummy parts were examined by using IR photography. The skin images found were recorded and compared with published findings. These bodies come from different contexts: from well-documented excavations or from museum collections without any records.
When analyzing the different types of skin signs, it becomes clear that this custom was widespread in pre-Columbian Andean societies. A large corpus of symbols, signs and patterns was used, some specific, others general. However, it seems possible to typologize them and assign them to specific archaeological cultures.

CORRESPONDENCE TO: **robin.gerst@gmx.de**

P 04

Research and conservation of human remains: cross contributions

Timbart, Noelle (Département Restauration, Centre de recherche et de restauration des musées de France (C2RMF), Paris, France); Langlois, Juliette (France); Colson, Isabelle (Service des musées de France, Ministère de la culture, Paris, France); Balcar, Nathalie (Département Restauration, Centre de recherche et de restauration des musées de France (C2RMF), Paris, France); Richardin, Pascale (Département Recherche, Centre de Recherche et de Restauration des musées de France (C2RMF), Paris, France); Vandenberghe, Yannick (Département Recherche, Centre de Recherche et de Restauration des musées de France (C2RMF), Paris, France); Lattuati-Derieux, Agnès (Département Recherche, Centre de Recherche et de Restauration des musées de France (C2RMF), Paris, France);

Human remains represent a significant part of the collections preserved in French museum institutions. If, for a long time, these collections were put aside and given little care of by the heads of the institutions, today the situation has changed. Many projects carried out around human mummies, as well as animal ones, favour a dual approach, mixing research and restoration whenever possible. Indeed, restoration is the privileged moment of the study which, with various examination and analysis tools, not only provides knowledge about the individual, mummification processes and funeral practices, but also essential information to adapt the conservation treatment protocol and the mode of presentation to the public. More than for any other type of collection and because of their specific nature, any intervention (like research, study, conservation) must be carried out according to strict rules of deontology and ethics as defined especially by ICOM (International Council of Museums). Consequently, restoration is most often limited to a minimal intervention to respect the human dimension of the remains or to conserve potential information for future studies. In recent years, the C2RMF (Centre de recherche et de restauration des musées de France) has received numerous human remains for study, restoration and a new presentation in showcases. This communication wishes to highlight, through several examples the cross contribution between research and restoration for the study of these very particular human remains, as well as the methodologies and the protocols implemented for their conservation-restoration and their presentation to the public.

CORRESPONDENCE TO: **noelle.timbart@culture.gouv.fr**

P 06

Like a fingerprint – morphological and morphometric variability of the frontal sinuses in ancient Egyptian mummies

Spinek, Anna (Department of Anthropology, Hirszfeld Institute of Immunology and Experimental Therapy, Polish Academy of Sciences, Wroclaw, Poland); Kubicki, Konrad (Department of Neurosurgery, Department of Neurosurgery, Jan Mikulicz-Radecki University Teaching Hospital, Wroclaw, Poland);

The frontal sinuses are one of the four paranasal sinuses. Fluctuation in pneumatization, which determines differences in shape, capacity and symmetry, and thus individualizing the morphology, causes that among all paranasal sinuses, frontal sinuses are the most characteristic and unique for a human, like a fingerprint.
The aim of the study is to demonstrate the findings of x-ray images and CT scans performed on Egyptian mummies, concerning morphometric and morphological diversity of the frontal sinuses.
The research material consisted of 23 mummified heads of adult individuals (11 females and 12 males) over 20 years of age, as sinus development is assumed to end at this age. This material constitutes a part of the osteological collection of the Department of Anthropology at the Polish Academy of Sciences in Wrocław, Poland.
The estimation of the sex and age-at-death of each individual was performed using standard anthropological methods. The frontal sinus images were obtained from radiographs taken in the coronal and sagittal plane and from the CT scans. The morphometric measurements such as height, width, and depth of right and left sinus separately were taken, and area and volume were counted. In addition, morphological features including frontal sinus pneumatization pattern (aplasia/hypoplasia/medium/hyperplasia), bilateral asymmetry, the superiority of the side, the outline of the upper border, presence and number of partial septa, and presence/absence of supraorbital cells were noted.
Collected data were then compared across the entire group as well as within sex based subgroups. Differences between the right and left sinuses were also assessed.

CORRESPONDENCE TO: **anna.spinek@hirszfeld.pl**

P 07

Mass burial genomics reveals an association between HLA-DRB1*03 and Paratyphoid Fever in Medieval Europeans

Haller, Magdalena (Institute of Clinical Molecular Biology, Christian-Albrechts-University Kiel, Kiel, Germany); Bonczarowska, Joanna H. (Institute of Clinical Molecular Biology, Christian-Albrechts-University Kiel, Kiel, Germany); Krause-Kyora, Ben (Institute of Clinical Molecular Biology, Christian-Albrechts-University Kiel, Kiel, Germany); Nebel, Almut (Institute of Clinical Molecular Biology, Christian-Albrechts-University Kiel, Kiel, Germany); Lenz, Tobias L. (Research Unit for Evolutionary Immunogenomics, University of Hamburg, Hamburg, Germany); Rieger, Dirk (Hansestadt Lübeck, Archäologie und Denkmalpflege, Lübeck, Germany);

Medieval Europe was repeatedly affected by outbreaks of infectious diseases, some of which reached epidemic proportions, leaving behind a large number of dead often inhumed in mass graves. This over proportional pathogen exposure could have acted as a powerful selective pressure on the human immune gene-pool.
In this study, we investigated a mass burial from 14th century Germany, suspected to contain the victims of the plague. Instead, we found molecular evidence of Salmonella enterica Paratyphi C, a pathogen responsible for paratyphoid fever, which was likely the cause of death for at least 120 of the buried individuals. This presented the unique opportunity to conduct the first study on the genetic predisposition to Salmonella infection in Europeans and the only association analysis on paratyphoid fever so far.
We generated HLA profiles for 29 medieval S. Paratyphi C cases and 24 contemporaneous controls and compared these to a modern German population. The frequency of the risk allele HLA-DRB1*03:01 for enteric fever was higher in medieval cases than in contemporaneous controls. Relative to the modern controls the frequency difference is statistically significant and suggests a decrease in the allele's prevalence over time and a slightly reduced predisposition to paratyphoid fever in modern Europeans. Interestingly, the causative allele is subject to balancing selection, providing resistance to infectious respiratory diseases such as severe respiratory syndrome (SARS). It is thus possible that ancient epidemics of paratyphoid fever affected the level of genetic resistance against respiratory diseases, predisposing present-day Europeans to an infection with the causative coronavirus.

CORRESPONDENCE TO: **m.haller@ikmb.uni-kiel.de**

P 08

The post-mortem Clostridium effect in mummies

Rudbeck, Emilio (Institute for Mummy Studies, Eurac Research, Bolzano, Italy); Sarhan, Mohamed (Institute for Mummy Studies, Eurac Research, Bolzano, Italy); Valverde, Guido (Institute for Mummy Studies, Eurac Research, Bolzano, Italy); Wurst, Christina (Institute for Mummy Studies, Eurac Research, Bolzano, Italy); Zink, Albert (Institute for Mummy Studies, Eurac Research, Bolzano, Italy); Maixner, Frank (Institute for Mummy Studies, Eurac Research, Bolzano, Italy);

After death, bacteria of the genus Clostridium use their various proteases to escape the gut and to colonize, due to the hypoxia in the body, the surrounding tissues. The pattern and abundance of this post-mortem colonization has been correlated with different factors, such as sex, tissue-type, and time since death, giving rise to the post-mortem Clostridium effect (PCE). To date, this effect has only been studied in modern cadavers. We therefore analyzed a large set of metagenomes from human mummies of different times and global distribution to see whether traces of the PCE are still present in these ancient specimens. By using an in-house developed pipeline, we assembled and taxonomically classified bins of Clostridiaceae which we then clusteredagainst sample-specific metadata. Through this we discovered three main correlations between the samples and the Clostridium spp.. Firstly, we found an association for the presence of similar Clostridium spp. in Egyptian samples and Bolivian trophy heads. Furthermore, we identified a taxonomic correlation between Bolivian mummies and an 18th century natural mummy from Switzerland. Finally, we see Clostridium spp. that only are present in the natural glacier mummy Iceman. Overall, we detected in all analyzed mummies traces of the PCE which seems to correlate on species level to the mummification/tissue type of the individuals.

CORRESPONDENCE TO: **emilio.rudbeck@gu.se**

P 09

The enhancement of mummies as a pull factor for the audience: an analysis between brand management and promotion of territorial and tourism in Italy

Leopardi, Laura (Sapienza University of Rome, Italy); Malatesta, Saverio Giulio (Archeo&Arte3D DigiLab, Sapienza University of Rome, Italy); Manzollino, Roberta (Sapienza University of Rome, Rome, Italy);

Human mummies can often have an important emotional impact on several people and affect the enhancement of territories. A new audience was born from the evolution of the cultural tourism, as an example in the case of the pop culture or fandom market: the tourism flows are aimed at seeking specific emotional experience, which focus on literature or film interest. Another revolution in the touristic industry is related to the disputable case of dark tourism when the concept of travel meets the death topic. The latter is historically important reason of pull: from the pilgrimage for the games of ancient Rome, the so-called Ludii Gladiatori, to the Middle Ages where the execution became a public show, to the Contemporary period where both themes are connected with the territories characterized by war memories, such as the Holocaust Museums or places of bloody battles, such as Normandy. Human mummification catches both the above-mentioned topics and it may assign new forms and scopes in a typical schematization of geographic contests in the territory enhancement. We investigated several case studies, for instance the Umbrian city of Ferentillo (TR) in the Valnerina area, normally meant for naturalistic activity. In 2016, collapses caused by the earthquake revealed other human mummies. The exhibition of these discoveries at the "Mummies Museum" increased visits up to 150 daily people. This work aims to highlight the territorial impact, according to turistic, social, and economics themes,makings related to the exhibition of mummies.

CORRESPONDENCE TO: **roberta.manzollino@uniroma1.it**

P 10

Chasing ancient pathogens: A look into the ancient tuberculosis research of the Vác Mummy Collection

Jäger, Heidi Yoko (Institute for Mummy Studies, Eurac Research, Bolzano, Italy); Maixner, Frank (Institute for Mummy Studies, Eurac Research, Bolzano, Italy); Pap, Ildikó (Department of Biological Anthropology, Faculty of Science and Informatics, University of Szeged, Szeged, Hungary); Szikossy, Ildikó (Department of Anthropology, Hungarian Natural History Museum, Budapest, Hungary); Pálfi, György (Department of Biological Anthropology, Faculty of Science and Informatics, University of Szeged, Szeged, Hungary); Zink, Albert (Institute for Mummy Studies, Eurac Research, Bolzano, Italy);

The Vác Mummy Collection (VMC) housed at the Hungarian Natural History Museum comprises 265 naturally mummified individuals from Hungary buried in a local crypt between 1731 and 1838 in pinewood coffins. Since their discovery in 1994, numerous studies have been conducted applying anthropological and molecular methods showing that the majority of the individuals suffered from latent or active Mycobacterium tuberculosis (MTB) infections, the causing agent of tuberculosis. Nevertheless, retrieving sufficient genomic pathogen sequencing data to perform in-depth analyses remains challenging due to the nature of ancient DNA and exogenous contamination by other microbial DNA. Therefore, we believe it is crucial to take a step back to investigate technical optimizations that could offer important insights to improve the study of the evolutionary history of the MTB complex. Here, we aimed to extend the collection of ancient genomic MTB data with particular emphasis on the detection of mixed MTB infections and optimization of the molecular workflow, specifically adapted for skeletal specimens, by applying modified sampling techniques and DNA extraction protocols. Out key findings show the following: (1) intra-bone variability of samples can affect pathogen DNA yield (2) DNA precipitation using linear polyacrylamide is highly purifying, and an effective alternative to silica-based DNA extractions, and (3) a mixed MTB infection in a 62-year-old midwife demonstrates the long-time prevalence of the European sublineages L4.1.2.1/Haarlem and L4.10/PGG3 within the local community. Finally, we highlight the vast potential of the VMC to study local epidemiological links and transmission events by combining genetic data and historical records.

CORRESPONDENCE TO: **heidi.jaeger@eurac.edu**

P 11

Genomic Analysis of Late Iron Age Individuals from Münsingen-Rain (Switzerland, 420-180 BCE)

Meiseleder, Lisa (Institute for Mummy Studies, Eurac Research, Bolzano, Italy); Zingale, Stefania (Institute for Mummy Studies, Eurac Research, Bolzano, Italy); Paladin, Alice (Institute for Mummy Studies, Eurac Research, Bolzano, Italy); Coia, Valentina (Institute for Mummy Studies, Eurac Research, Bolzano, Italy); Laffranchi, Zita (Department of Physical Anthropology, Institute of Forensic Medicine, University of Bern, Bern, Switzerland); Lösch, Sandra (Department of Physical Anthropology, Institute of Forensic Medicine, University of Bern, Bern, Switzerland); Müller, Felix (Bernisches Historisches Museum, Bern, Switzerland); Milella, Marco (Department of Physical Anthropology, Institute of Forensic Medicine, University of Bern, Bern, Switzerland); Cemper-Kiesslich, Jan (Department of Forensic Medicine and Forensic Neuropsychiatry, University of Salzburg, Salzburg, Austria); Maixner, Frank (Institute for Mummy Studies, Eurac Research, Bolzano, Italy); Zink, Albert (Institute for Mummy Studies, Eurac Research, Bolzano, Italy);

The site of Münsingen-Rain (Canton of Bern, Switzerland, 420-180 BCE) is a landmark context for the study of the European Late Iron Age due to its rich archaeological record and clear horizontal stratigraphy. Previous morphological studies suggested the presence of two main family groups among the buried individuals. To date, a test of such hypothesis has been discouraged by the results of classical PCR-based ancient DNA (aDNA) analyses, which pointed to a poor preservation of human DNA. We applied Next Generation Sequencing (NGS) methods to investigate the endogenous human DNA quality of the skeletal remains in Münsingen-Rain. For this, we selected 27 individuals (represented by 5 teeth and 22 petrous bones) from burials representing different chronological phases. First results of the shotgun sequencing show in most cases (23/27: 85.2%) a good preservation of the human aDNA, with an average human endogenous content of 7.8%. The mean nuclear coverage ranges from 0.0023 X to 0.0563 X. Damage pattern of the aDNA fragments and the length of the reads support the authenticity of the ancient human endogenous DNA. We estimated a low contamination by comparison with mitochondrial DNA. Thus, NGS-based methods returned results previously unattainable using classical PCR-based methods. Planned genomic analyses (e.g. nuclear enrichment) will allow us to estimate the genetic relatedness among these individuals and to compare it with the archaeological, anthropological and isotopic patterns from the site. By combining these datasets, we aim to gather new insights into the social organization of individuals from the cemetery in Münsingen-Rain.

CORRESPONDENCE TO: **meiselederlisa@gmail.com**

P 12

Paleogenetic Analysis of Pediculosis of Andean Mummies from the Atacama Desert, Chile

Lopes, Laiz (Laboratório de Biologia de Tripanosomatídeos-IOC/Fundação Oswaldo Cruz, Fundação Oswaldo Cruz-FIOCRUZ, Rio de Janeiro, Brazil); Brito, Lorrayne (Museu de Arqueologia e Etnologia da Universidade de São Paulo – USP and FIOCRUZ BRASIL, Universidade de São Paulo and FIOCRUZ, Rio de Janeiro, Brazil); Arriaza, Bernardo (Departamento de Antropología Instituto de Alta Investigación, Universidade de Tarapacá – CHILE, Tarapacá, Chile); Iñiguez, Alena (Laboratório de Biologia de Tripanosomatídeos-IOC/Fundação Oswaldo Cruz, Fundação Oswaldo Cruz-FIOCRUZ, Rio de Janeiro, Brazil);

Pediculosis, an infestation caused by human louse Pediculus humanus, is still an important public health problem with a worldwide distribution. The louse is an obligate hematophagous ectoparasite with direct transmission, and through the study of its lineages, it is possible to represent the evolutionary history of its human hosts. In both the Old and the New Worlds, paleoparasitological research has revealed high rates of louse infestation affecting societies. The objective of the present study is to examine hair lice from 10 pre-Columbian Andean mummies, dating from the Archaic to the Late Period, to understand the genetic diversity of these ancient parasites and their human hosts in the past. Ancient DNA was extracted from lice of mummified individuals from 6 archaeological sites in Arica and Tarapacá regions, northern Chile, using the DNeasy Plant Mini Kit (Qiagen). Samples were subjected to PCR and Sanger sequencing methods using markers to determine P. humanus genotypes, cytb, 12S rDNA, cox1, and human haplotypes, HVS-I mtDNA. If P. humanus genotypes are detected in all mummified individuals, our hypothesis is that the diversity of P. humanus changed over time, as a consequence of the growth of the human population and the increased cross-cultural contacts. As preliminary results, we obtained P. humanus aDNA sequences from lice of two individuals from Quiani-7 and Tarapacá-40 archaeological sites, corresponding to the Late Archaic/Formative and Formative periods, respectively. In particular, the ancient lice from Tarapacá revealed a fragment sequence that possibly belonged to clade A, the clade with the largest worldwide distribution.

CORRESPONDENCE TO: **laiz.skinner@hotmail.com**

P 13

Cataloging mummies. Experiences from the Museum of Anthropology and Ethnography of Turin (Italy)

Boano, Rosa (Department of Life Sciences and Systems Biology, University of Turin, Turin, Italy); Mangiapane, Gianluigi (Department of Philosophy and Education Sciences, University of Turin, Turin, Italy); Sciatti, Angela (Department of Life Sciences and Systems Biology, University of Turin, Turin, Italy); Fiore Marochetti, Elisa (Soprintendenza Archeologia Belle Arti e Paesaggio per la Città Metropolitana di Torino, Ministry of Culture, Turin, Italy); Pennacini, Cecilia (Department of Cultures, Politics and Society, University of Turin, Turin, Italy);

According to the Italian Code of Cultural Heritage (Legislative Decree 42/2004 s.m.i), cataloging is a part of scientific activities that characterize themuseums; in this perspective, in recent decades, also universities and their museums have launched various projects for cataloging their collections, some of them regarding biological remains. The Central Institute for Catalog and Documentation (ICCD) of the Italian Ministry of Culture manages the national general catalog and it has made available, on the web-based platform "SIGECweb", the AT 3.0 catalog card for human remains. In 2021 the Museum of Anthropology and Ethnography of the University of Turin (MAET), has launched a cataloging campaign on the Egyptian Anthropological Collections, consisting of about 500 skulls, 600 skeletons, 30 mummified or embalmed bodies and 80 heads. The cataloging has been started with the 80 mummified heads. On the digital platform, we are collecting all historical, archaeological, anthropological and paleopathological information recovered from archive documents and current scientific studies. At the same time, an assessment of the macro, micro and molecular state of conservation is underway in order to proceed, where required, with restoration interventions. In the poster presentation, we discuss the prospects and the challenges of this scientific activity that include also ethical measures for storing, handling and preserving human remains in the MAET.

CORRESPONDENCE TO: **rosa.boano@unito.it**

P 14

Acquisition of cross-sectional images for the diagnostic evaluation of ancient human remains in remote areas and under challenging field conditions

Eppenberger, Patrick (Institute of Evolutionary Medicine / Swiss Mummy Project, University of Zurich, Zurich, Switzerland); Seiler, Roger (Institute of Evolutionary Medicine / Swiss Mummy Project, University of Zurich, Zurich, Switzerland); Rühli, Frank (Institute of Evolutionary Medicine / Swiss Mummy Project, University of Zurich, Zurich, Switzerland);

Paleoradiology requires specific adaptations and developments to account for the wide variety of findings, potential postmortem alterations, and circumstances often arising from limited transportability or remote find locations of unique ancient biological specimens. The Swiss Mummy Project has extensively established the general feasibility of various paleoradiological techniques, including extensive field research using portable digital radiography units in Egypt and Sudan (Egyptian Museum in Cairo, Saqqara, Bahariya Oasis, Valley of the Kings, Sheikh Abd el-Qurna, Al-Asasif, Khartoum). However, complex anatomical structures, such as the skull base, often cannot be adequately represented by planar radiographs due to superimposition artifacts, unlike tomographic imaging techniques such as CT or micro-CT, which can resolve such limitations. Therefore, a low-cost device for acquiring cross-sectional images in remote areas and under challenging field conditions would be of great interest for bioarcheological research. Based on our available portable digital projection X-ray unit, we have recently developed a low-cost portable system that can capture digital projection radiographs of specimens from different, geometrically well-defined angles for subsequent reconstruction of cross-sectional images. Our system thus allows us to perform “cone-beam” CT imaging of specimens up to 400 mm in diameter with an isotropic resolution as low as 100 µm under field conditions. This invention obtained an international patent (Pat. N° EP3870053A1).

CORRESPONDENCE TO: **patrick.eppenberger@iem.uzh.ch**

P 15

The Mummies of Guanajuato's Life Stories

Abreu Abreu, María José (Universidad de Guadalajara, Guanajuato, Mexico)

This research shows the results of the historical recovery of the life stories of those who were the Mummies of Guanajuato alive. The Museum of the Mummies of Guanajuato has a collection of 117 mummified bodies that were exhumed from the Santa Paula's Municipal Cementery, most of them in the second half of the 19th Century and the first half of the 20th Century. There is evidence of his acts in life, thanks to documents and public records housed in archives. Thus, it was possible to obtain real names, ages, causes of death, burial and exhumation dates, addresses, trades, professions, business relationships and civil acts.
Such research is pertinent because, over the years, legends, fake stories, and myths have been formulated around the mummies collection, which has caused visitors to receive made-up stories or inaccurate data about the bodies. The exaltation of morbidity and commodification has been considered, without ethical and dignified treatment. This information lacks f support and methodological rigor that determines its authenticity.
It is intended that the results of this research serve to make an exhibition proposal that allows exposing the mummies in a dignified manner, weighing ethical and bioethical principles in the exhibition of mummified bodies, considering that "they are the concrete testimony of the ones who were people and, therefore, deserves respect for their life stories, mores and traditions" (National Council of Bioethics, 2021).

CORRESPONDENCE TO: **mjabreuabreu@gmail.com**

P 16

Disturbing elements and preservation problems in a medieval natural mummy: animal nesting

Minozzi, Simona (Department of Translational Research and New Technologies in Medicine and Surgery, University of Pisa, Pisa, Italy); Giuffra, Valentina (Department of Translational Research and New Technologies in Medicine and Surgery, University of Pisa, Pisa, Italy); Fornaciari, Antonio (Department of Translational Research and New Technologies in Medicine and Surgery, University of Pisa, Pisa, Italy); Gaeta, Raffaele (Department of Surgical, Medical, Molecular Pathology and Critical Area, University of Pisa, Pisa, Italy); Lunardini, Agata (Department of Civilization and Forms of Knowledge, University of Pisa, Pisa, Italy);

After the death, human corpses are frequently colonized by animals that are prevalently represented by invertebrates, mainly insects, which play a role in decomposition processes. The mummified body is not only a source of food for animals but may represent support for nesting.
The case regards an unusual finding of rodent nesting in the natural mummy of Saint Atto (+1153), a prominent figure of the early medieval Pistoia who entertained wide-ranging European relations. He was a Vallombrosan monk and became abbot and then bishop of Pistoia. The well-preserved mummy is exposed in the Cathedral of San Zeno of Pistoia (Tuscany, Italy).
The investigation of the body was performed by macroscopic examination, endoscopy, X-ray and CT scan, revealing the presence of intrusive elements inside the body. The endoscopic examination, performed through a groin lesion in the soft tissues, revealed the presence of a feline skeletonized paw and an allogenic human finger, partially mummified. The CT scan revealed, in the left side of the thoracic cage, the presence of a rodent's lair. The activities of the rodents caused the chaotic movement of the internal tissues and organs, which were probably used to build the lair, and the accumulation of any sort of debris, such as fragments of paper, fabrics, and vegetables.
The aim of this study is to describe and discuss the presence of rodents nesting in a natural mummy and the modifications caused by this unusual finding, focusing on the preservation problems.

CORRESPONDENCE TO: **simona.minozzi@unipi.it**

P 17

Breasts in Dynastic Egypt

Warwick, Alexandra (KNH Centre for Biomedical Egyptology, University of Manchester, Manchester, United Kingdom);

There are no current publications regarding the significance of the breasts in ancient Egypt or of their treatment during the mummification process. In men, representation of gynecomastia in art signified fecundity and success. In women, the significance was greater, with breastfeeding and motherhood being central to a woman's role in society and in divine practice.
This project sought to look for evidence of specific attempts at preservation, reconstruction, or adornment of the breasts during mummification by studying the available CT and x-ray data of Dynastic mummies. Where original data was unavailable, published radiological images, photographs of mummified remains, and reports of early 20th century mummy investigations were closely examined.
Analysis of gender, sexuality, religious belief, literature, medicine, and artistic representations in ancient Egypt was carried out to try to understand the significance of the breast during life, death, and the afterlife and therefore the significance of the results of this project.
Despite the substantial cultural and religious significance of the breasts, there is currently very little evidence for there being any special measures being taken during the mummification process. Current data shows evidence for only a few rare cases of subcutaneous packing of the breasts during the Dynastic Period. Further study of original CT data needs to be carried out to specifically look for mummification practices centred around the breasts as this is an area previously unstudied during radiological examination and evidence may have been overlooked in favour of other research interests.

CORRESPONDENCE TO: **acj.warwick@yahoo.com**

P 18

The assemblage of animal mummies in Poland

Braulinska, Kamila (Faculty of Archaeology, University of Warsaw, Warsaw, Poland);

Taken as a whole, the animal mummies from collections in Poland have not been studied in depth, either individually or as an assemblage. Several are known from occasional photos, a website, a few mentions in museum catalogues, some early X-rays while investigating human mummies; the most extensive work has recently been done on the Warsaw assemblage, which has been the object of an investigative project since 2015. The Polish Animal Mummy Project, which was launched in 2020, aims to fill this gap, collecting and studying all of the animal mummies and sarcophagi kept in Poland, their history, bioarchaeology, material analysis, etc., with the use of traditional as well as innovative techniques. The presentation is an introduction to this assemblage, giving an overview of the hitherto completed research.
The over 50 objects in this assemblage are part of the ancient Egyptian collections in the National and Archaeological Museums in Warsaw, Kraków and Poznań, as well as the University of Warsaw and Jagiellonian University in Kraków. Some are on loan from Polish and European institutions. Most of the mummies are of a votive nature, representing seemingly standardized groups. However, radiological imaging has revealed a much more diverse picture yielding also composite and pseudo-mummies. Moreover, the study surprisingly revealed remains of a species that has not been mentioned before in the museum assemblage it belongs to. Some of the objects have even turned out to have a known provenience, which is not that obvious in the case of animal mummies worldwide.

CORRESPONDENCE TO: **ks.braulinska@uw.edu.pl**

P 19

Introduction and identification of burials obtained from the archeological excavation of the Kamin cemetery, Fars Province, Iran

Nafari, Resa (Azad University, Marvdasht, Iran)

Kamin Cemetery is located in southern side of Derak Mountain and West of Shraz city in Fars Province. The cemetery was discovered in 2016 during the construction of shiraz medical university. About 7 hectares of cemetery were destroyed and only 3 hectares remained intact. During an excavation project 16 graves were explored in the north of cemetery and geophysical survey to distinguish the extent of graveyards carried out in an about 2 ha. The most important structural features of the graves include, using rabble stone inside the chamber, placing a large stone in the southern parts of the graves as a symbol as well as constructing an entrance to the burial chamber. Pottery, bronze and stone objects were placed near the body might be functioned as burial gifts. According to archaeological evidence it seems probable that Kamin Cemetery may be related to the nomadic populations of about 2000 B.C. The present report summarizes the findings during the 1st season of excavation carried out in this cemetery.

Key words: Kamin cemetery. Burials. Archaeology. Structural.

CORRESPONDENCE TO: **rezanafari1987@gmail.com**

P 20

Cryoprervation Isochoric with atmosphere modification of the Llullaillaco Mummies in Salta – Argentina

Bernaski, Mario (Director of the High Mountain Archeology Museum, Salta, Argentina); Recagno, Gabriela (Department of Research the High Mountain Archeology Museum, High Mountain Archeology Museum, Salta, Argentina); Zigarán, María Fernanda (Conservation Laboratory of the High Mountain Archeology Museum, Salta, Argentina);

Cryopreservation Isochoric (constant volume), with atmosphere modification brings new method in the conservation of naturally frozen archeological bodies.
This paper will present the case of the Children of Llullaillaco, contemplating an approach to endogenous and exogenous aspects of these bodies found at more than 6700 m.a.s.l. In addition, technological aspects of the cryopreservation system and the conditions contemplated for the correct long-term conservation and its museological presentation will be explained.

CORRESPONDENCE TO: **mario@bernaski.com.ar**

P 21

Are we winging it? – Assessing confidence levels in the zooarchaeological identification of bird taxa contained within animal mummies

McKnight, Lidija (School of Biological Sciences, The University of Manchester, Manchester, United Kingdom)

Interpretation of the contents of wrapped animal mummy bundles using radiography is standard practice in Egyptological research; however, accurate species identification of skeletal remains hidden from view under layers of linen wrappings is unreliable. Bird remains mummified, wrapped and dedicated as votive offerings to the ancient Egyptian gods represent a plentiful and varied body of material, with seventy-seven avian species identified in the mummy record (Wyatt, pers. comm. 2014).
Morphological variations in avian remains are complex and challenging to distinguish even with specialist knowledge and access to comparative skeletal reference collections. Additional complications occur when bundles contain incomplete, fragmentary and co-mingled skeletal remains from more than one individual or from multiple species.
Our Egyptological interpretation of this archaeological resource centres around our ability to identify species. Consistency and accuracy is paramount when incorrect species attributions adversely affect our ability to understand these mummies as religious devices within a complex belief system.
This paper presents the results of an ongoing research project between the Natural History Museum (Tring), Loughborough Design School and the University of Manchester. Experimental mummification, imaging and 3D replication are used to investigate the reliability and relative accuracy of current avian mummy identification methods.

CORRESPONDENCE TO: **lidija.mcknight@manchester.ac.uk**

P 22

Histological study of pulmonary tuberculosis in a 19th-century natural mummy from Comiso (Sicily, Italy)

Gaeta, Raffaele (Division of Paleopathology, Department of Translational Research, University of Pisa, Pisa, Italy); Giuffra, Valentina (Division of Paleopathology, Department of Translational Research, University of Pisa, Pisa, Italy); Fornaciari, Antonio (Division of Paleopathology, Department of Translational Research, University of Pisa, Pisa, Italy);

Introduction. In Italy collections of mummies preserved in crypts and chapels are frequent, in particular in the central and southern regions. In Comiso (Sicily) the mortuary chapel of the church of Santa Maria della Grazia, built in the 18th century by the Capuchins, hosts 50 mummies lying in niches.
Methods. We analysed the natural mummy of an anonymous friar dressed in a Capuchin tunic who died at about 30-35 years. The head was missing due to post depositional events, but the body was in good conditions. In particular, the skin and soft tissues of the upper limbs, hands, chest, and abdomen were completely preserved. The macroscopic examination and the tissue samples were conducted through breaches already present in the dorsal side. Histological and histochemical analyses were performed on samples of pulmonary parenchyma.
Results. 7 intra parenchymal calcified nodules in the left lung with a diameter between 2 and 5 mm were found. Histological examination showed alveolar atelectasis with fibrosis and intense anthracosis. The fibrocalcific nodules showed some small lacunae surrounded by fibrous tissue, containing necrotic and caseous material. These findings are compatible with the calcification of a previous Ghon complex of an apical nodular tuberculosis. We can therefore assume that the friar probably came into contact with the mycobacterium, after which he developed the primary infection.
Conclusions. The mummy of the friar revealed calcific post-primary tuberculosis. The case of Comiso confirms the large spread of the disease in the 19th century, when it reached its maximum peak in Europe

CORRESPONDENCE TO: **raffaele.gaeta@med.unipi.it**

P 23

Preservation of endogenous DNA in cat mummies from ancient Egypt

Rovelli, Valentina (Centre of Molecular Anthropology for Ancient DNA Studies, Tor Vergata University, Rome, Italy); De Cupere, Bea (Royal Belgian Institute of Natural Sciences, Brussel, Belgium); Van Neer, Wim (Royal Belgian Institute of Natural Sciences, Brussel, Belgium); Ottoni, Claudio (Centre of Molecular Anthropology for Ancient DNA Studies, Tor Vergata University, Rome, Italy);

Domestic cats are semi-ubiquitous inhabitants of the world, where they live side-by-side with humans. Despite this prolonged relationship, many aspects of cats' domestication still need to be properly understood. This lengthy and complex process sinks its roots in the Neolithic Levant, where the wild ancestor of all domestic cats, Felis silvestris lybica, interacted for the first time with humans, and Egypt, where cats were objects of a popular cult since the 1st millennium BC. Previous ancient DNA (aDNA) studies showed that cats in ancient Egypt possessed two maternal lineages commonly found in modern domestic cats. Haplotype-C, which spread all over the Old World since Classical Antiquity from Northern Africa, and haplotype-A, which was associated with an earlier cat dispersal from the Levant during the Neolithic. From the 1st millennium BC until the 4th century AD, cats in Egypt were mummified as votive offerings to the goddess Bastet. Today, aDNA from cat mummies represents a key tool to unravel the role of Egypt as a possible independent center of domestication.
Here, we show preliminary results of cutting-edge aDNA techniques applied on more than 50 Egyptian cat mummies from Beni Hassan and Gourna (Luxor), dated to the Greco-Roman period. Our study provides an extensive case for screening DNA preservation in arid regions and within different tissues, such as hair, claws, and petrous bones. We also explore the potential to gain novel insights on the dispersal of domestic cats from Egypt in Classical Antiquity through mitochondrial and genome-wide data.

CORRESPONDENCE TO: **valentinarovelli.bio@gmail.com**

P 24

Evidence of ancient Egyptian treatment of a purulent soft tissue infection

Panzer, Stephanie (Radiology, Berufsgenossenschaftliche Unfallklinik Murnau, Murnau am Staffelsee, Germany); Treitl, Marcus (Radiology, Berufsgenossenschaftliche Unfallklinik Murnau, Murnau am Staffelsee, Germany); Zesch, Stephanie (German Mummy Project, Reiss-Engelhorn-Museen, Mannheim, Germany); Rosendahl, Wilfried (German Mummy Project, Reiss-Engelhorn-Museen, Mannheim, Germany); Helmbold-Doyé, Jana (Ägyptisches Museum und Papyrussammlung, Staatliche Museen zu Berlin, Berlin, Germany); Thompson, Randall C (Saint Luke's Mid America Heart Institute, University of Missouri, Kansas City, U.S.A.); Zink, Albert R (Institute for Mummy Studies, Eurac Research, Bolzano, Italy);

The Edwin Smith Papyrus (ca. 1650-1550 BC) is a didactic trauma treatise from ancient Egypt. Signs of such a treatment were visible on a computed tomography examination of an ancient Egyptian child mummy that is housed in the Ägyptisches Museum und Papyrussammlung Berlin, Germany and dates to the 1st-2nd century AD.
A kind of bandage was detected at the left lower leg and hyperdense masses spread within the adjacent soft tissues, presumably consistent with dried pus and thus indicated purulent cellulitis or abscess. Cellulitis and abscess are a common global health burden in the modern world, and are suggested to have been it also in ancient Egypt.
Case 41 of the Edwin Smith Papyrus describes an infection of a wound: "One who has infection in a wound… which is inflamed-hot/infected and because of which he is febrile". The wound is described as remaining open, greatly inflamed and swollen, hot, red, and with an oily discharge. The ancient Egyptian physician recommended "cooling remedies for drawing out the heat from the mouth of the wound", "a remedy for drying the wound" including natron salt, and a powder, all of them applied with a bandage of the wound.
This seems to be the first study regarding soft tissue infections such as purulent cellulitis or abscesses in ancient mummies. Therefore, we see this case as precedent. The radiological visualization of the original bandage presumably of a skin lesion that caused the deep infection contributes to the field of ancient Egyptian medicine.

CORRESPONDENCE TO: **stephanie.panzer@bgu-murnau.de**

P 25

"Hands-on Archaeological and Historical Medical Collections": An educational Activity

Moulson, Aaron J. (University of British Columbia, Vancouver, Canada); Monsalve, Maria (Pathology & Laboratory Medicine, University of British Columbia, Vancouver, Canada);

The UBC MD undergraduate medical program includes a longitudinal scholarship course that spans Years 1, 2 and 4 of the curriculum. This curriculum provides an opportunity to introduce students to the field of paleopathology. The aim of the project is for the students to develop competency in the recognition, characterization and systematic analysis of skeletal remains. The creation of a repository of images of human bones with pathological conditions provides the students hands-on access to archaeological bone collections from Latin America and Europe. Using images, MD undergraduate medical students develop differential diagnoses of pathological and traumatic conditions in the skeletal remains. This "Hands-on Archaeological and Medical Records" project offers medical students interesting and novel interpretations of anatomy, an introduction to historical care provision and helps them in the decision making process for postgraduate studies. Images from collections around the world will increase the scope of past diseases. Furthermore, it will advance knowledge of stages of diseases that may not often be available in countries with modern medical care.

CORRESPONDENCE TO: **vmonsalve@pathology.ubc.ca**

P 26

Insights into ancient Egyptian genomes in the first Millennium BC

Salem, Nada (Department of Archaeogenetics, Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany); Gnecchi Ruscone, Guido Alberto (Department of Archaeogenetics, Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany); Furtwängler, Anja (Department of Archaeogenetics, Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany); Bianco, Raffaela (Department of Archaeogenetics, Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany); Freilich, Suzanne (Department of Archaeogenetics, Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany); Mötsch, Angela (Department of Archaeogenetics, Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany); Teßmann, Barbara (Museum für Vor- und Frühgeschichte Berlin, Staatliche Museen Preußischer Kulturbesitz, Berlin, Germany); Frenzel, Hannah (Institute of Anatomy, Leipzig University, Leipzig, Germany); Spyrou, Maria (Institute for Archaeological Sciences (INA), University of Tübingen, Tübingen, Germany); Harvati, Katerina (Institute for Archaeological Sciences (INA), University of Tübingen, Tübingen, Germany); Graves, Lisa (Bristol Museum and Art Gallery, Bristol, United Kingdom); Ringbauer, Harald (Department of Archaeogenetics, Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany); W. Stockhammer, Philipp (Department of Archaeogenetics, Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany); Krause, Johannes (Department of Archaeogenetics, Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany);

In contrast to the outstanding cultural heritage of ancient Egypt, bioarchaeological data from the region is rare. Being situated at the border between Africa and Asia, continuity and changes of genomic signatures across Egypt pose a most interesting and relevant topic. This is especially true in the first millennium BC, when ancient Egypt witnessed foreign domination by the neighboring populations including Libyans, Nubians, Assyrians, Greeks, Romans and others, whose roles vary from trade and exchange to invasion and rule. Despite being potential to addressing questions on the population's demographic, retrieval of ancient DNA from the Egyptian mummies has greatly been challenged by the presence of contamination and the poor preservation. As such, genome-wide data for ancestry analyses is known for only three Egyptian mummies that were retrieved from a single site (Abusir el-Meleq, Schuenemann et al. 2017). Here we report a preliminary, rigorously tested genome-wide dataset from 14 mummies recovered from various sites in Upper, Lower and West Egypt including Thebes, Deir el-Bahri, Abydos, Abusir el-Meleq, Hawara, Meidum and ad-Dakhla Oasis, whose spanning around 1300 years of ancient Egyptian history, from the New Kingdom to the Roman period. Our study aims to characterize the major ancestry components for ancient Egyptians and to explore the genetic continuation and admixture through times and regions.

CORRESPONDENCE TO: **nada_salem@eva.mpg.de**

P 27

The Quinto infant mummy PQ 27: a possible case of septicaemic death

Loynes, Robert (University of Manchester, Manchester, United Kingdom); Nerlich, Andreas (Institute of Pathology, Academic Clinic Munich-Bogenhausen, München Klinik GmbH, Munich, Germany); Gonzalez, Mercedes (Institute for the Scientific Study of Mummies (IECIM), Madrid, Spain); Jardiel Badia, Antonio (Museo de las Momias de Quinto, Zaragoza, Spain); Begerock, Anni (Institute for the Scientific Study of the Mummies (IECIM), Madrid, Spain); Bianucci, Raffaella (Department of Cultures and Societies, University of Palermo, Palermo, Italy);

Within the Human Embalming Project©, we investigated the state of preservation and the cause of death of a late 18th century child (ID= PQ27), whose natural mummy was exhumed from the Piquete church in Quinto (Spain). The mummy is displayed in the Museo de las Momias de Quinto. The infant wore a long sheet covered by a shirt. The body is in an excellent state of preservation.
Computed tomography (CT) established that the body belonged to a male aged 12 to 16 months at death; the crown-heel average measurement was ca 60 cm. Preserved meninges, cerebral remnants and desiccated eye globes with retention of the intra-thoracic (heart and diaphragm) and intra-abdominal tissues (liver) with solidified putrefaction fluid were identified. The skeletal remains did not show evidence of pathological conditions. However, a penetrating defect with irregular margins, measuring 2.18 x 3.5 cm, was identified over the lateral aspect of the right knee joint. The fabric covering the lesion displayed a circumscribed rounded discoloration consistent with perimortem exudation of serum/blood. Histopathological analysis revealed the presence of droplet-like deposits of hemosiderin in the superficial dermis; this finding proves intra-vitam bleeding which occurred from 3 to 5 days prior to death but possibly also for a longer period. We propose that, in the pre-antibiotic era, the skin lesion became infected and, ultimately, led to the development of lethal septicaemia.

CORRESPONDENCE TO: **robert.loynes@manchester.ac.uk**

P 28

Genomics and proteomics analysis on Egyptian Mummies: the case of "Ankhekhonsu" of the Civic Archaeological Museum of Bergamo, Italy

Soggiu, Alessio (Department of Biomedical, Surgical and Dental Sciences, DSBCO, University of Milan, Milano, Italy); Malgora, Sabina (Mummy Project Research, Casale Monferrato, Italy); Creminelli, Luca (Department of Biomedical, Surgical and Dental Sciences, University of Milan, Milano, Italy); Bonizzi, Luigi (Department of Biomedical, Surgical and Dental Sciences University of Milan, Milano, Italy); Milani, Chantal (Forensic anthropologist and odontologist, Rome, Italy); Motta, Francesca (Mummy Project Research, Rome, Italy); Carrafiello, Gianpaolo (Department of Oncology and Hemato – Oncology , University of Milan, Milan, Italy); Bulfoni, Alessandro (Obstetrics and Gynaecology, Humanitas - Pio X Hospital, Milan, Italy); Bernardo, Luca (Department of Pediatrics, University of Milan - Fatebenefratelli Hospital, Milan, Italy); Nicola, Marco (ADAMANTIO - Science in Conservation s.r.l, Turin, Italy); Scalarone, Dominique (Department of Chemistry, University of Turin, Turin, Italy); Elias, Jonathan (Mummy Project Research, Italy); Casini, Stefania (Civic Archaeological Museum of Bergamo, Bergamo, Italy);

This study is part of the multidisciplinary analysis led by Mummy Project APS on the Egyptian mummy named "Ankhekhonsu" of the Civic Archaeological Museum of Bergamo (Italy).
The mummy was first CT scanned, then underwent to an endoscopy using a Storz Medicals/ Carlo Bianchi Advanced Technologies video-broncoscope.
Following the endoscopy on the body, the skull of the mummy has been moved to "Clinica Odontoiatrica" of the Ospedale Maggiore Policlinico of Milan and the samples collected (endocranial dust, dental material, and periosteum) has been analyzed in the Genomics and Proteomics laboratory of Department of Biomedical, Surgical and Dental Sciences, of University of Milan.
A cone beam CT scan was performed on the skull with relative OPT. subsequently, samples of dental caries, tartar and periosteum were taken and subjected to metagenomic analysis with the MinION MK1C system (Oxford Nanopore ltd) to characterize the microbiome present in the analyzed samples.
Through bioinformatic analysis of DNA sequences 6.93 megabases were obtained. Overall, 657 reads were classified and at least 50 different genera were identified in the microbiome of the mummy. The next step of the project will be to analyze the characteristics of each bacterial species identified and correlate them not only to potential environmental characteristics of the place of origin but also to the health conditions of the mummy at the time of death.

CORRESPONDENCE TO: **alessio.soggiu@unimi.it**

P 29

Archaeology of mummification and gender: revisiting an 18th century female monastery in São Paulo, Brazil

Da Silva, Sérgio F.S.M (Departamento de Arqueologia, Universidade Federal de Pernambuco, Recife, Brazil); Solari, Ana (FUMDHAM, INAPAS, São Raimundo Nonato, Brazil); Pessis, Anne Marie (FUMDHAM, INAPAS, São Raimundo Nonato, Brazil); Martin, Gabriela (FUMDHAM, INAPAS, São Raimundo Nonato, Brazil); Fontes, Luiz R. de O. (Instituto Médico Legal de Sao Paulo, Sao Paulo, Brazil); Fuzinato, Daniela V. (Museu de Arqueologia e Etnologia, Universidade de Sao Paulo, Sao Paulo, Brazil);

Our research recovers primary data from the archaeological excavation carried out between 2008 and 2009 at the Mosteiro da Luz, a religious institution dating from the 18th century, located in the city of São Paulo, Brazil. This religious building has three cemeteries. The need to control soil termites generated an archaeological excavation that showed six wall funus carnarium in the cloister's mortuary chapel containing a layer of soil, bodies of 5 unidentified mummified nuns, and 6 skeletons, also female, with signs of mummification and taphonomic action by termites. The analysis of three funus carnarium more than 1 meter from the ground, two double and one simple, indicated the presence of natural mummification of bodies, which varied with temperature and relative humidity (averages of 23oC and 50% RH). The bodies that were about 20 cm from the brick floor underwent skeletonization predominantly, with few traces of mummification and signals of re-accommodation of skeletons without or with partial anatomical connection between the bone elements. The ways of re-accommodating bones and mummies were approached by archaeothanatological techniques of observation of their burial contexts. No signs of necropsy or traces of artificial preparation for embalming these bodies were observed. Thermite action was recorded in 90.9% of the buried bodies. This is a pioneering research in gender archeology and mummification in the case of female monasteries in Brazil, because of their underground nature and association with the use of methods and techniques of archaeothanatology with the participation of professionals in the forensic sciences.

CORRESPONDENCE TO: **anasolari74@gmail.com**

P 30

Regarding a mummy: Overview and management plan for study of a naturally mummified body displayed at the Museu do Homem Americano, Brazil

Solari, Ana (FUMDHAM, INAPAS, São Raimundo Nonato, Brazil); Menéndez, Lumila Paula (Department of Anthropology of the Americas, University of Bonn, Bonn, Germany); Daltrine, Gisele Felice (Department of Archaeology, Universidade Federal do Vale do São Francisco, São Raimundo Nonato, Brazil); Souto Maior, Paulo Martin (Departamento de Arqueologia, Universidade Federal de Pernambuco, Recife, Brazil); Pessis, Anne Marie (FUMDHAM, INAPAS, São Raimundo Nonato, Brazil); Guidon, Niede (FUMDHAM, INAPAS, São Raimundo Nonato, Brazil);

The hold, display, and research of human remains in museum collections pose didactic and ethical challenges. The Museu do Homem Americano (MHA) was created to guard and preserve the cultural heritage left by prehistoric peoples in the region of the Serra da Capivara National Park (Piauí, Brazil), a UNESCO World Heritage site. The permanent exhibition shows the results of five decades of research in the area, including funerary urns and human skeletons, which are carefully displayed to help visitors learn about their past.
Here, we focus on the naturally semi-mummified body of an infant exhibited at the MHA, which stands out for preserving soft tissues such as skin and hair. The Urn 9 from Toca da Baixa dos Caboclos is a single primary burial of an infant dated to 310 ± 50 BP (cal AD 1460-1670). This individual presents natural mummification due to desiccation within the funerary ceramic urn. It was accompanied by funerary goods such as bow and arrow.
We present the current management plan aiming to optimize research, science communication, and conservation of a mummified corpse. It includes studying the biological affinities through morphometric and genetic studies, analyzing the sediments contained in the urn to explore the taphonomic processes of natural mummification, planning the most appropriate conservation actions, and designing a respectful display of the body with regard and sensitivity.
We conclude that the study of the past, through human remains, should be addressed respectfully since it has an enormous relevance for protecting the legacy of future generations.

CORRESPONDENCE TO: **anasolari74@gmail.com**

P 31

Facial depiction of a Roman period mummy with portrait from the Fayoum Oasis, Egypt

Liu, Jessica (Face Lab, Liverpool John Moores University, Liverpool, United Kingdom); Wilkinson, Caroline (Face Lab, Liverpool John Moores University, Liverpool, United Kingdom); Roch, Adelina (Department of Life Sciences and Technology, Biotechnology- Forensic Sciences, Van Hall Larenstein University of Applied Sciences, Leeuwarden, Netherlands); Zesch, Stephanie (German Mummy Project, Reiss-Engelhorn-Museen, Mannheim Germany); Mussauer, Alexandra (Institute for Mummy Studies, Eurac Research, Bolzano, Italy); Paladin, Alice (Institute for Mummy Studies, Eurac Research, Bolzano, Italy); Zink, Albert (Institute for Mummy Studies, Eurac Research, Bolzano, Italy);

The portrait mummy has been discovered in Er-Rubayat (Fayoum Oasis) in 1887 and is dated (14C) to the Roman Period (1st – 2nd cent. AD). That dating is also supported by the iconographic details of the mummy portrait presenting the face of a young girl with typical Roman hair style and jewellery. In the years following its discovery, the mummy together with other mummy portraits found in Er-Rubayat, were acquired by the Austrian merchant Theodor Graf. Only in the 1927, a number of objects from Graf's collection were purchased for the Collection of Classical Antiquities at the Berlin museum (Germany), and in 1989 the mummy was handed over to the Egyptian Museum and Papyrus Collection, where it is housed today (inventory number: ÄM 36101/01).
The individual was CT scanned in 2015, in the framework of an interdisciplinary project, and the anthropological analysis confirmed that the mummy belonged to a child.
The Institute for Mummy Studies of Eurac Research collaborated with the Face Lab from Liverpool John Moores University for a facial reconstruction of that individual. Textural choices often rely on historical records and/or interpretation provided by historians, archaeologists, and/or the reconstruction practitioner; the final depiction is therefore often affected by confirmation bias in relation to gender, ancestry and culture. This poster will present the osteological analyses and the depiction process, with specific focus on how the portrait painting may have influenced some of the textural choices of the final depiction.

CORRESPONDENCE TO: **c.y.liu@ljmu.ac.uk**

P 32

Cognitive bias in textural decisions for the depiction of the ancient Egyptian mummy, Takabuti

Shrimpton, Sarah (Face Lab, Liverpool John Moores University); Wilkinson, Caroline (Face Lab, Liverpool John Moores University)

In 2008, a craniofacial reconstruction and depiction was created using the skull of Takabuti, a 25th Dynasty Ancient Egyptian Princess from Thebes. A 3D printed model of the CFR, with painted textures, was created and is currently on display at the Ulster Museum in Northern Ireland. Skin "textures" and hairstyle choices were guided by the wider research team as part of a broader picture of Takabuti's life. Recently, the depiction was revised in a 2D digital format to incorporate further analysis on the remains of Takabuti, alongside re-evaluation of the format and texture presentation to reflect a more considered approach for how to texture facial reconstructions of ancient remains.
Textural decisions can be influenced by cognitive bias from our cultural ideals of how Ancient Egyptians should look, in relation to not only gender and race identity, but also to stereotypical depictions of ancient civilisations in comparison to contemporary populations. Consideration should also be made to the pose and expression depicted in the depiction, given their role in social perception and judgements of faces, and their ability to impart unknown 'character' behaviours. To avoid using stereotypes and in contrast to the original colour painted 3D model with braided wig, a choice was made, based on available evidence, to present her digitally in greyscale with an average luminance. This served to avoid the definition of skin-tone/pigment. Clear evidence of hair preservation allowed for the hair to be presented in colour to mimic the correct tone, texture and style. Two hairstyles were modelled; one styled in a chignon, with makeup considered in use during the period, and one with hair down and no makeup. As evidence for texture can be ambiguous and often insufficient to make definitive choices, multiple presentations afford the flexibility of interpretation of the evidence and suggest less rigidity and specificity around living facial appearance.

CORRESPONDENCE TO: **s.l.shrimpton@ljmu.ac.uk**

P 33

What are the current methods for presenting digital facial depictions of ancient Egyptian mummies to public audiences, and what opportunities and ethical challenges do emerging technologies present?

Roughley, Mark (Senior Lecturer 3D Digital Art and Research Assistant in Face Lab, Liverpool School of Art & Design, Liverpool, United Kingdom)

In the computer game and movie industries we are seeing great advances in the production of digital humans that look, move and talk like real people with convincing realism. Technologies and methods used by these industries are being adopted by facial reconstruction specialists in order to depict people from their skeletal remains, including Egyptian mummies, and to allow the public to see and interact with a person from the past in unexpected ways. However, these technologies and methods also pose a number of ethical questions. When working with ancient human remains, we must be aware of our contemporary biases surrounding these populations in terms of appearance and personality of the individual, especially where the archaeological or biological record do not provide such information. Alongside making choices relating to skin, eye and hair appearance, caution must be taken when choosing to animate such depictions, where mis-representation and dis-mediation could occur. While these technologies provide opportunities for these digital humans to 'live' in current times and potentially forever; or as long as their computer files exist, this poster describes some of the current methods for presenting facial depictions of people from the past but also discusses the ethical challenges that must be considered.

CORRESPONDENCE TO: **m.a.roughley@ljmu.ac.uk**

P 34

Two facial depictions of Guanche children from the summit of Tenerife (Canary Islands)

Castañeyra Ruiz, María (Face Lab, Liverpool John Moores University, Liverpool, United Kingdom); Rodríguez Caraballo, Selene (Geography and History Department, University of La Laguna, San Cristóbal de La Laguna, Spain); Marrero Salas, Efrain (Geography and History Department, University of La Laguna, San Cristóbal de La Laguna, Spain); Ordóñez, Alejandra C. (Geography and History Department, University of La Laguna, San Cristóbal de La Laguna, Spain); Arnay de la Rosa, Matilde (Geography and History Department, University of La Laguna, San Cristóbal de La Laguna, Spain); Shrimpton, Sarah (Face Lab, Liverpool John Moores University, Liverpool, United Kingdom); Wilkinson, Caroline (Face Lab, Liverpool John Moores University, Liverpool, United Kingdom);

The study of the juvenile remains, documented in archaeological contexts, is becoming a common practice in current research on the indigenous populations of the Canary archipelago. However, there are still no studies that address a complete bioanthropological characterization of infant individuals, including the reconstruction of their facial features. In sepulchral caves located on the summit of Tenerife, individual burial deposits for children have been found, in a good state of preservation and some of them partially mummified. This paper presents the results obtained from the study of Guanche children located in Las Cañadas del Teide, which includes a variety of analysis from genetic characterization to facial reconstruction/depiction.

CORRESPONDENCE TO: **m.castaneyraruiz@ljmu.ac.uk**

P 35

In search of TB among the members of the Hausmann family: Mycocerosic acid-based TB diagnostics via HPLC-HRMS

Váradi, Orsolya A. (Department of Biological Anthropology, Faculty of Science and Informatics, University of Szeged, Szeged, Hungary; Department of Microbiology, Faculty of Science and Informatics, University of Szeged, Szeged, Hungary); Spekker, Olga (Department of Biological Anthropology, Faculty of Science and Informatics, University of Szeged, Szeged, Hungary); Szikossy, Ildikó (Department of Biological Anthropology, Faculty of Science and Informatics, University of Szeged, Szeged, Hungary; Department of Anthropology, Hungarian Natural History Museum, Budapest, Hungary); Szvák, Enikő (Department of Anthropology, Hungarian Natural History Museum, Budapest, Hungary); Rakk, Dávid (Department of Microbiology, Faculty of Science and Informatics, University of Szeged, Szeged, Hungary); Terhes, Gabriella (Institute of Clinical Microbiology, Faculty of Medicine, University of Szeged, Szeged, Hungary); Pap, Ildikó (Department of Biological Anthropology, Faculty of Science and Informatics, University of Szeged, Szeged, Hungary; Department of Anthropology, Hungarian Natural History Museum, Budapest, Hungary; Department of Biological Anthropology, Eötvös Loránd University, Budapest, Hungary); Maixner, Frank (Institute for Mummy Studies, Eurac Research, Bolzano, Italy); Zink, Albert (Institute for Mummy Studies, Eurac Research, Bolzano, Italy); Vágvölgyi, Csaba (Department of Microbiology, Faculty of Science and Informatics, University of Szeged, Szeged, Hungary); Donoghue, Helen D. (Centre for Clinical Microbiology, University College London, London, United Kingdom); Minnikin, David E. (Institute of Microbiology and Infection, School of Biosciences, University of Birmingham, Birmingham, United Kingdom); Szekeres, András # (Department of Microbiology, Faculty of Science and Informatics, University of Szeged, Szeged, Hungary); Pálfi, György # (Department of Biological Anthropology, Faculty of Science and Informatics, University of Szeged, Szeged, Hungary);
# The two last authors contributed equally.

Tuberculosis (TB) indicates a perennial burden on humankind, thus the focus of research keeps to be drawn on the evolution and pathomechanism of its causative agents, namely on the members of Mycobacterium tuberculosis complex (MTBC). Beside the great stability of the bacterial cell wall and the rise of drug resistant strains, several risk factors (e.g. poor living conditions, smoking, HIV infection, etc.) are making this disease even more concerning. As for another risk factor, being in close contact with a TB infected person requires special attention. Although paleopathology has been serving valuable data in TB research for a long time, investigating the impact of transmission among family members is hardly possible in past populations. An exceptional opportunity has been provided on this topic by the examination of the Vác Mummy Collection. A large group of naturally mummified individuals from the 18th century CE were found in the crypt of the Dominican church of Vác, in 1994. Later investigations carried out exploration of family connections; furthermore, among the paleopathological findings, in many instances the traces of TB related aDNA was confirmed. The aim of this poster is to present and compare the mycocerosic acid based results gained from the three known members of the Hausmann family, a mother and two of her daughters. In the case of two individuals, analyses provided positive signs of TB infection, and in the case of one individual, some non-definitive traces are suggesting the possibility of the infection, as well.

CORRESPONDENCE TO: **varadi.orsolya.90@gmail.com**

P 36

Memento and lullaby for an unborn baby from the Vác mummy crypt

Szvák, Enikő (Department of Anthropology, Hungarian Natural History Museum, Budapest, Hungary; Department of Anthropology, PhD School in Biology, University of Szeged, Szeged, Hungary); Pap, Ildikó (Department of Anthropology, PhD School in Biology, University of Szeged, Szeged, Hungary); Madai, Ágota (Department of Anthropology, Hungarian Natural History Museum, Budapest, Hungary); Girčius, Rokas (Department of Anatomy, Histology, and Anthropology, Vilnius University, Vilnius, Lithuania); Piombino-Mascali, Dario (Department of Anatomy, Histology, and Anthropology, Institute of Biomedical Sciences, Vilnius University, Vilnius, Lithuania);

In 1994, during the renovation of the so-called White Church (located in Vác, Hungary), a forgotten crypt with 265 naturally mummified individuals was discovered. Besides the adult individuals, bodies of many infants and children have also been successfully identified. In several cases, details with the personal records of the deceased were obtained as the coffin inscriptions were quite accurate and informative. On the basis of the combination of the aforementioned historical and legal (birth and death registries) data, the reconstruction of family relationships became possible. In 2021, we launched a new project at the Department of Anthropology of the Hungarian Natural History Museum following the development of new scientific research methods and as a consequence of the diverse condition of the bodies, which needed further investigation. The project is informed by previous research and it aims to review the Vác mummy collection and conduct additional multidisciplinary research. The most outstanding case we noticed when reviewing the documentation was that of a 25-30 years old woman. In the photographs it is clear that the bones of her unborn foetus were located in the birth canal, in between the woman's pelvic bones. The head of the foetus was close to the pubic region. According to the position of the remains, it can be speculated that the young woman may have died during birth. The woman's name and further details of the delivery are unknown due to the lack of any inscriptions on her coffin. Linear enamel hypoplasia was diagnosed on the teeth of her mandible and maxilla, suggesting that she must have lived in modest living conditions during her childhood. We intend to shed further light on this case by using CT scan and through a comprehensive paleopathological analysis, to obtain a nuanced view on both the mother's and the foetus's biohistories.

CORRESPONDENCE TO: **szvakeniko@gmail.com**

P 37

The beginning of the Nephthys project

Szvák Enikő (Department of Anthropology, Hungarian Natural History Museum, Budapest, Hungary; Department of Biological Anthropology, University of Szeged, Szeged, Hungary; PhD School in Biology/Human Biology-Anthropology, University of Szeged (SZTE), Szeged, Hungary); Sklánitz, Antal (Central Quality Laboratory, Continental Automotive Hungary Ltd, Budapest, Hungary); Szabó, Lénárd (Central Quality Laboratory, Continental Automotive Hungary Ltd, Budapest, Hungary); Kiss Mészáros, Zsuzsanna (Central Quality Laboratory, Continental Automotive Hungary Ltd, Budapest, Hungary); Béni, Áron (Institute of Agricultural Chemistry and Soil Science, University of Debrecen (DE), Debrecen, Hungary); János, István (Institute of Environmental Science, University of Nyíregyháza (NYE), Nyíregyháza, Hungary); Dobróné Tóth, Márta (Institute of Environmental Science, University of Nyíregyháza (NYE), Nyíregyháza, Hungary); Szikossy, Ildikó (Department of Anthropology, Hungarian Natural History Museum, Budapest, Hungary; PhD School in Biology/Human Biology-Anthropology, University of Szeged (SZTE), Szeged, Hungary); Szikszai, Zita (Institute for Nuclear Research, Hungarian Academy of Sciences, Debrecen, Hungary); Kertész, Zsófia (Institute for Nuclear Research, Hungarian Academy of Sciences, Debrecen, Hungary); Molnár, Mihály (Isotope Climatology and Environmental Research Centre (ICER), Institute for Nuclear Research, Hungarian Academy of Sciences (ATOMKI), Debrecen, Hungary); Major, István (Isotope Climatology and Environmental Research Centre (ICER), Institute for Nuclear Research, Hungarian Academy of Sciences (ATOMKI), Debrecen, Hungary); Győry, Hedvig (Museum of Fine Arts, Budapest, Hungary); Biacsi, Karola (The Hungarian University of Fine Arts, Budapest, Hungary); Molnár, Erika (Department of Biological Anthropology, University of Szeged, Szeged, Hungary); Hajdu, Tamás (Department of Biological Anthropology, Eötvös Loránd University (ELTE), Budapest, Hungary); Szeniczey, Tamás (Department of Biological Anthropology, Eötvös Loránd University (ELTE), Budapest, Hungary); Baranyai, Edina (Agilent Atomic Spectroscopy Partner Laboratory, Department of Inorganic and Analytical Chemistry, University of Debrecen, Debrecen, Hungary); Sajtos, Zsófia (Agilent Atomic Spectroscopy Partner Laboratory, Department of Inorganic and Analytical Chemistry, University of Debrecen, Debrecen, Hungary); László, Orsolya (Hungarian National Museum, Laboratory for Applied Research, Budapest, Hungary); Scheffer, Krisztina (Hungarian National Museum, Semmelweis Museum of Medical History, Budapest, Hungary); Hölzl, Regina (Kunsthistorisches Museum Wien, Ägyptisch-Orientalische Sammlung, Vienna, Austria); Tucom-Novak, Vanessa (Kunsthistorisches Museum Wien, Ägyptisch-Orientalische Sammlung, Vienna, Austria); Szirmai, László (MOL Ltd, Budapest, Hungary); Szőke, Attila (MOL Ltd, Budapest, Hungary); Erdődi, Marcell (Independent researcher, Budapest, Hungary); Rosendahl, Wilfried (Reiss-Engelhorn-Museen, Zentrum Kunst- und Kulturgeschichte, Mannheim, Germany); Zesch, Stephanie (Reiss-Engelhorn-Museen, Zentrum Kunst- und Kulturgeschichte, Mannheim, Germany); Zink, Albert R. (Institute for Mummy Studies, Eurac Research, Bolzano, Italy); Girčius, Rokas (Department of Anatomy, Histology, and Anthropology, Institute of Biomedical Sciences, Vilnius University, Vilnius, Lithuania); Piombino-Mascali, Dario (Department of Anatomy, Histology, and Anthropology, Institute of Biomedical Sciences, Vilnius University, Vilnius, Lithuania); Pálfi, György (Department of Biological Anthropology, University of Szeged, Szeged, Hungary); Pap, Ildikó (Department of Biological Anthropology, University of Szeged, Szeged, Hungary; PhD School in Biology/Human Biology-Anthropology, University of Szeged (SZTE), Szeged, Hungary);

The Nepthtys Project aims to carry out multidisciplinary research on ancient Egyptian mummified human remains in Hungary. The project involves the Hungarian Natural History Museum, the Aurél Török Collection of the Eötvös Lóránd University of Sciences, and the Semmelweis Medical History Museum of the Hungarian National Museum. During this research, the remains were subjected to anthropological and imaging investigations, organic and inorganic chemical analysis, skin, hair and textile microscopic investigation, as well as

radiocarbon isotope dating. The results were surprising: the mummy fragments involved in the project represent a wide time interval, from the end of the New Kingdom to the early Middle Ages. For instance, based on the sample's chronological age, it can be argued that it includes some false findings. During the palaeopathological examination, we identified a male skull, which had probably experienced blunt force trauma, and a female skull with a metatarsal bone inserted into the nasal cavity, presumably for aesthetic reasons. Not to mention that some fragmented crania of children show endocranial lesions, with a probable identification of infectious disease(s) still ongoing. In the case of a female's right leg, the specimen is badly bowed, and arched with a measured height of 37 mm. The tarso-metatarsal line is convex and the axes are misaligned. The identification of some materials used during the mummification procedure became possible due to the organic chemical analysis and, as a result of the microscopic analysis, ancient pollen residues were detected between the layers of the bandage. In some cases, inorganic chemical analysis highlighted increased lead content of the bone samples, but the causative agent of this phenomenon is still under investigation.

CORRESPONDENCE TO: **szvakeniko@gmail.com**

Acknowledgements

The Eurac Research Institute for Mummy Studies gratefully acknowledges the support of the following partners

Sponsor:

Info & Contact
Eurac Research – Institute for Mummy Studies
A.-Volta-Straße/Via A.-Volta 13/A
39100 Bozen/Bolzano
Italy
T +39 0471 055 560
mummycongress@eurac.edu