Pictorial essay:

COMPARATIVE ANATOMY BETWEEN HUMAN AND 'M TYPE' TRIDACTYLS

A scientific study using CT scan with advanced 3D image reconstruction and virtual dissection.

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ACKNOWLEDGEMENT

- The author wished to thank Tridactyls.org for granting permission for use of the DICOM CT datasets available on their website for this scientific study.

SECTION I: METHODOLOGY

- CT datasets of Nazca tridactyls 'mummies', namely '**Maria**', '**Montserrat**' and '**Sebastian**' were analysed in this study.
- These 3 named Nazca tridactyl 'mummies' (Figure 1,2,3,5) were considered representative of a group of bipedal tridactyl hominids. These so-called M type tridactyls show major resemblance to human but with obvious anatomical differences, featuring 3 fingers and 3 toes on hands and feet.
- 'Maria' appeared to be an aged adult of uncertain sex (with alleged female phenotype but having Y chromosome). (Figure 2) 'Montserrat' was documented to be pregnant containing a single fetus in-situ and representing a young adult female. (Figures 3,4) 'Sebastian' appeared to be an adolescent with unfused epiphyses in long bones, sex cannot be determined on CT alone. (Figures 5,6)
- All 3 named tridactyls were very well preserved desiccated complete corpses with internal organs. However, 'Maria' showed signs of degradation with one toe having sloughed off prior to CT scanning (all toes were intact when discovered). (Figure 7)
- Tendons and ligaments (Figure 8,18,43,44,46) were well preserved although shrunken due to dehydration and thus became adherent to bones (*resulting in difficulty in segmentation of the data from bone*). Extravasated blood (Figure 9) can be distinguished allowing for assessment of artefacts and injuries. Bowels contained coprolites, some with seeds. (Figure 10) Dental structures were well preserved. (Figure 11) Condition of cranial sutures could be assessed. (Figure 12) Remnants of brain tissue were found within the skull. (Figure 13)

SECTION I: METHODOLOGY *(continued)*

- Despite being covered with diatomaceous earth, CT can visualized the skin surface very well. The diatomaceous earth itself was not visualized on CT but foreign materials on the surface can be well distinguished. (Figures 14,15)
- Metallic implants (Figures 12,16) were found in the tridactyls and showed some metal artefacts (Figure 9) on CT scans that can be overcome with software manipulation, resulting in visualization of the metal implants isolated and in high clarity.
- Alignment abnormalities were well known to be pitfalls in reading only 2D axial CT scans but can be well visualized using advanced CT imaging methods e.g. various forms of multi-planar reconstruction, maximum or minimum intensity projections, direct volume rendering 3D reconstruction and shaded surface display 3D reconstruction (Figures 17,18) working in conjunction with advanced 3D image segmentation techniques.
- Accurate appropriate measurements of dimensions (linear, curved, area, volume, angle etc.) can be made on CT scans. Density measurements in Hounsfield units can be obtained at any point. 3D orientation, 3D alignment, visual size and shape comparison in 3D spaces can be made using advanced software.
- Combining visualization of different image elements e.g. soft tissue and bone can be made directly with volume rendered 3D reconstruction (Figure 17) by simply changing the window level and window width settings. In a different way, shaded surface display 3D reconstruction (Figure 6) allowed for combining different tissue elements through use of different threshold settings. Each method has their own merits and can be used as appropriate.
- 3D image elements can be sectioned, cropped, digitally removed or combined. The 3D images can be rendered semi-transparent or in false colours (Figure 19) using computer technology but based on real data.
- Virtual endoscopy and virtual autopsy can be performed.
- Cinematic display, interactive 3D display, stereoscopic 3D and 4D visualization can be further produced to display the resultant imageries.
- **Human anatomy** can be obtained from an archive of modern CT datasets and representative ones can be used for comparison purpose.

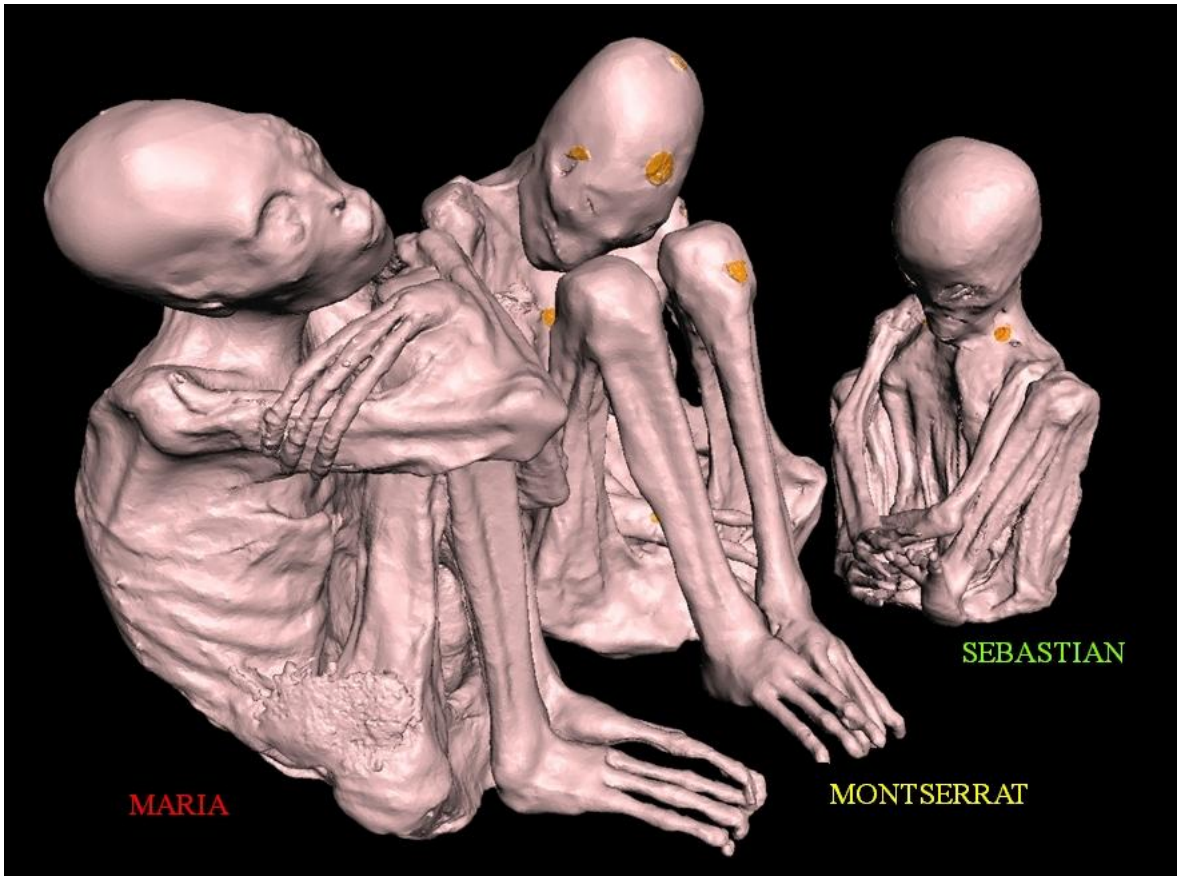

Figure 1: 3D CT showing ‘Maria’, ‘Montserrat’ and ‘Sebastian’ in foetal posture.

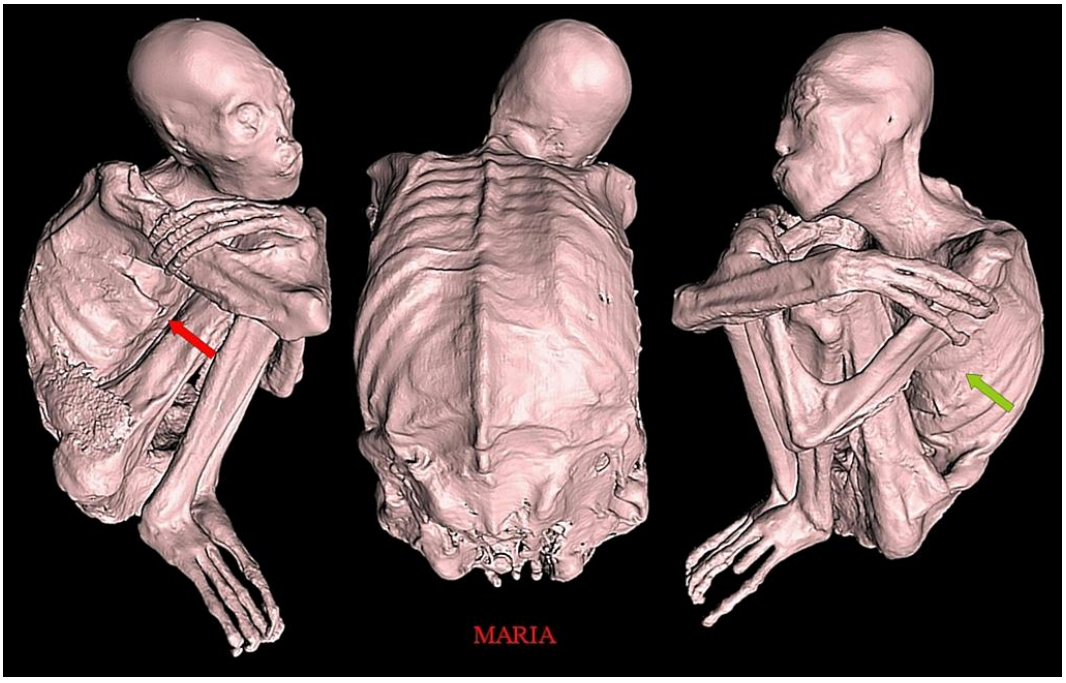

Figure 2: 3D CT of ‘Maria’ showing foetal posture. Note the very long multi-segmented digits in tridactyl hands and feet. ‘Maria’ was an aged adult. Her sex was a mystery. Right breast with nipple (red arrow) was found on her but lacking left breast (green arrow). She had Y chromosome.

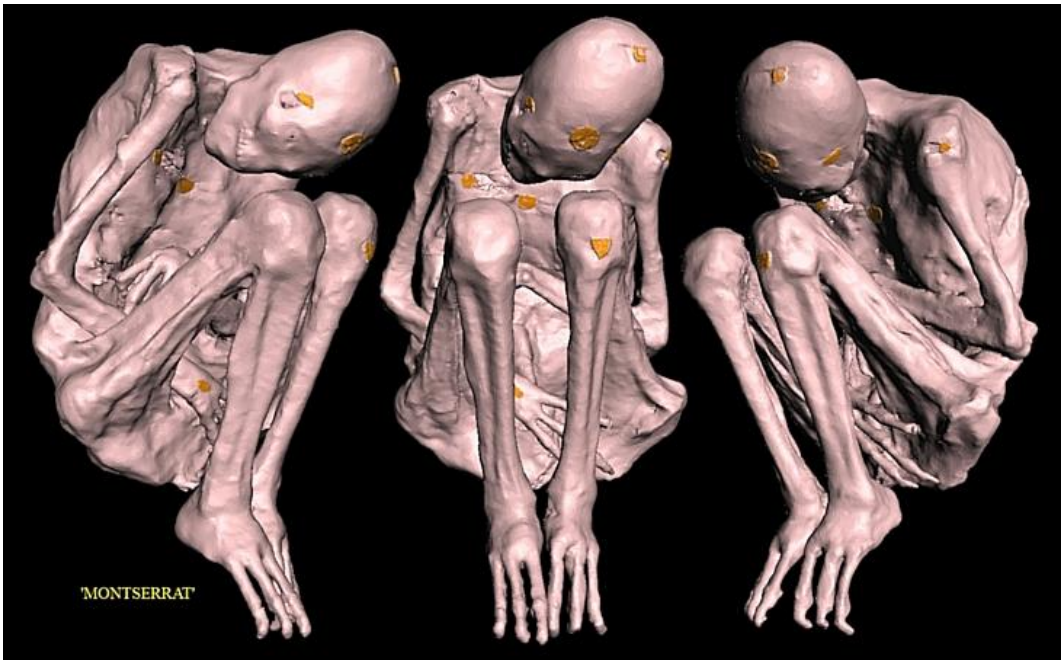

Figure 3: 3D CT of ‘Montserrat’ in foetal posture. 10 metallic implants could be found on the body of this tridactyl. ‘Montserrat’ was a young adult and found to be pregnant being a single foetus.

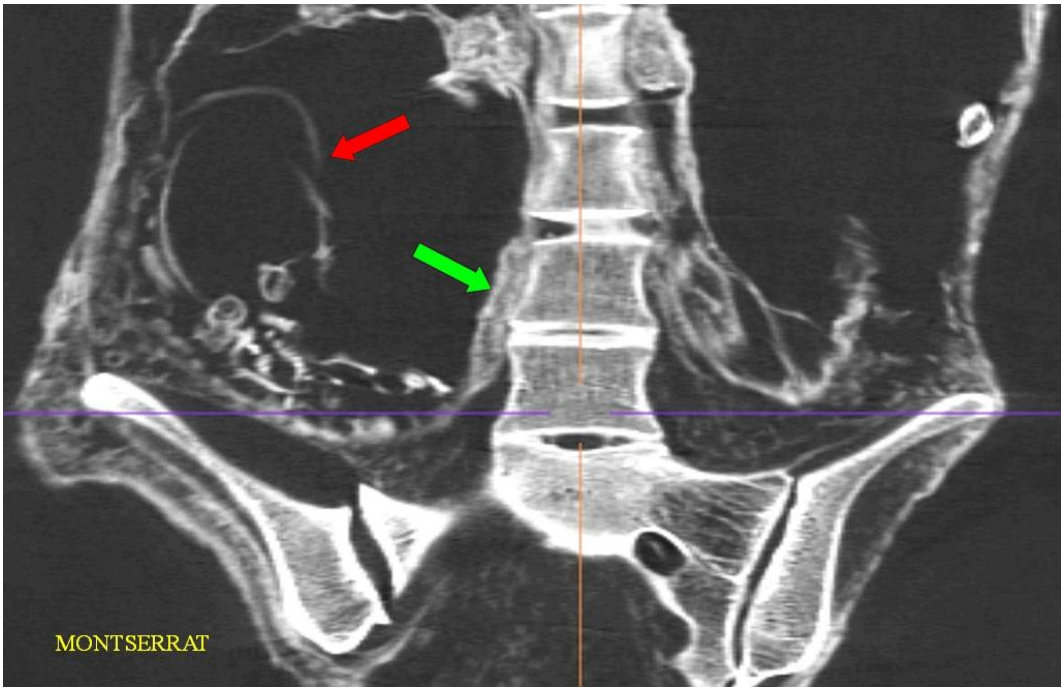

Figure 4: Coronal 2D CT scan of ‘Montserrat’ showing presence of foetus with crumbled overlapping skull bones (red arrow) within uterus in right side of abdomen. Part of the placenta was also shown. (green arrow)

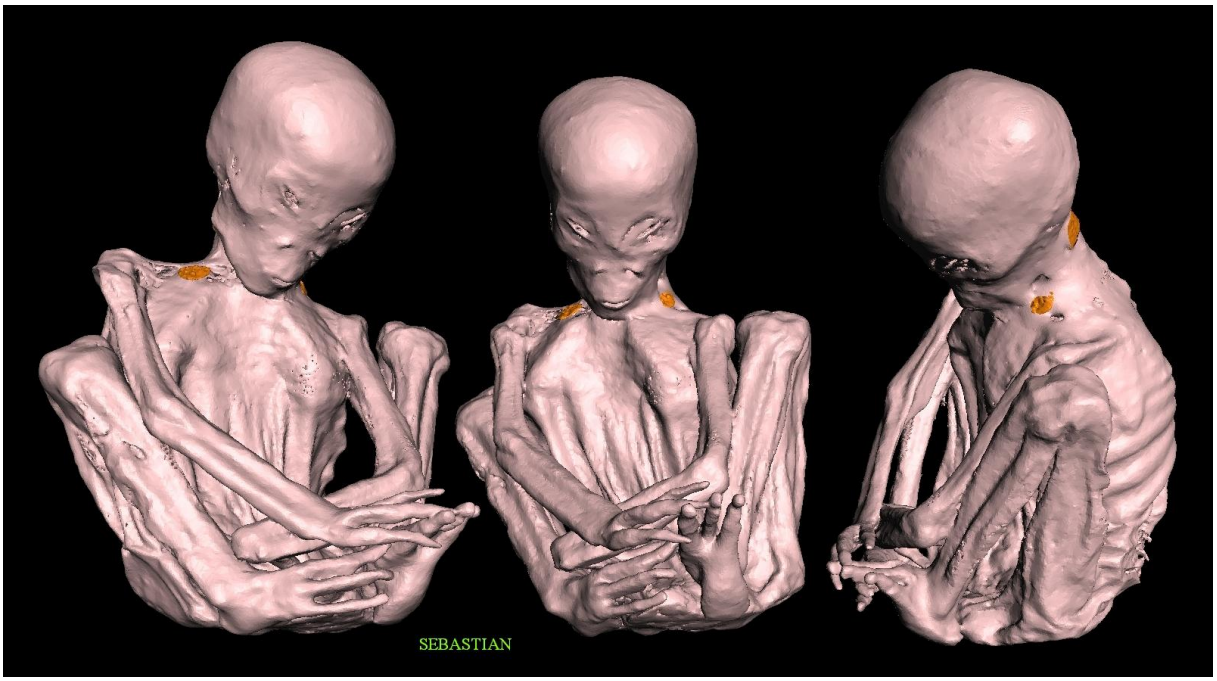

Figure 5: 3D CT showing various views of ‘Sebastian’, a dehydrated corpse of a child. Note presence of metallic implants in neck and supraclavicular areas. The depressed sternum and grossly abnormal shape of the rib cage appeared striking.

Figure 6: 3D CT in semi-transparency showing combined skin and bones of the right limb of ‘Sebastian’. Unfused epiphyses were noted in tibia, fibula and femur suggestive of an immature skeleton. Note the relatively more robust medial digit in foot. Digits were of similar sizes in ‘Maria’ or ‘Montserrat’.

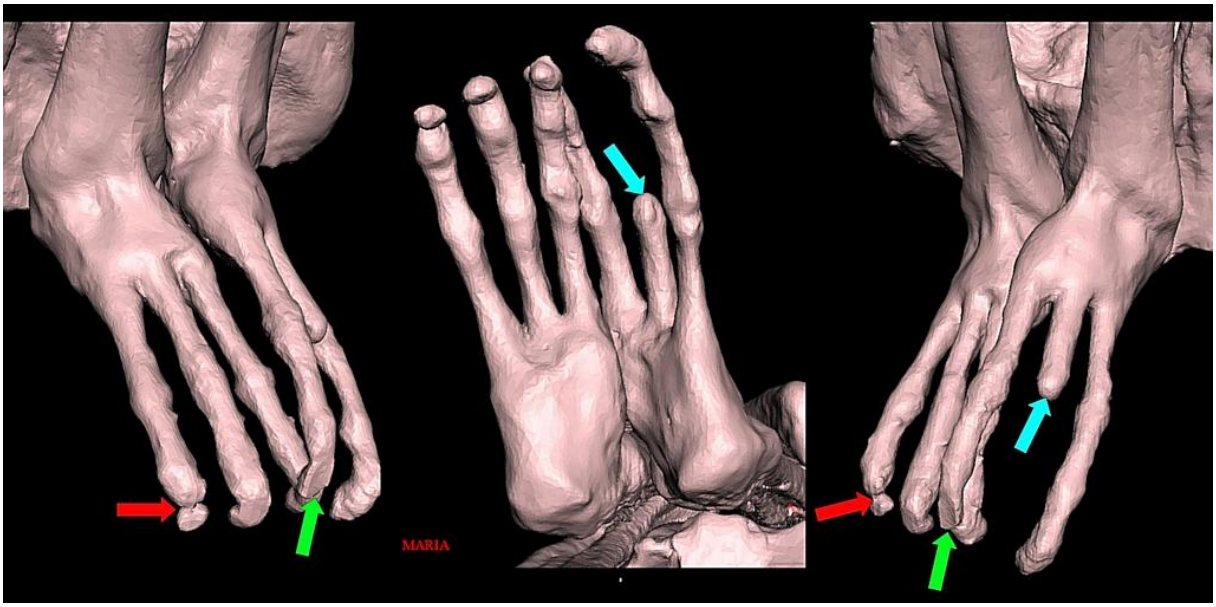

Figure 7: 3D CT showing toes of ‘Maria’. Note the tridactyl configuration. Part of the toes had slough off (blue arrows) or in the process of sloughing off (red and green arrows). The toes were reported to be complete at time of discovery.

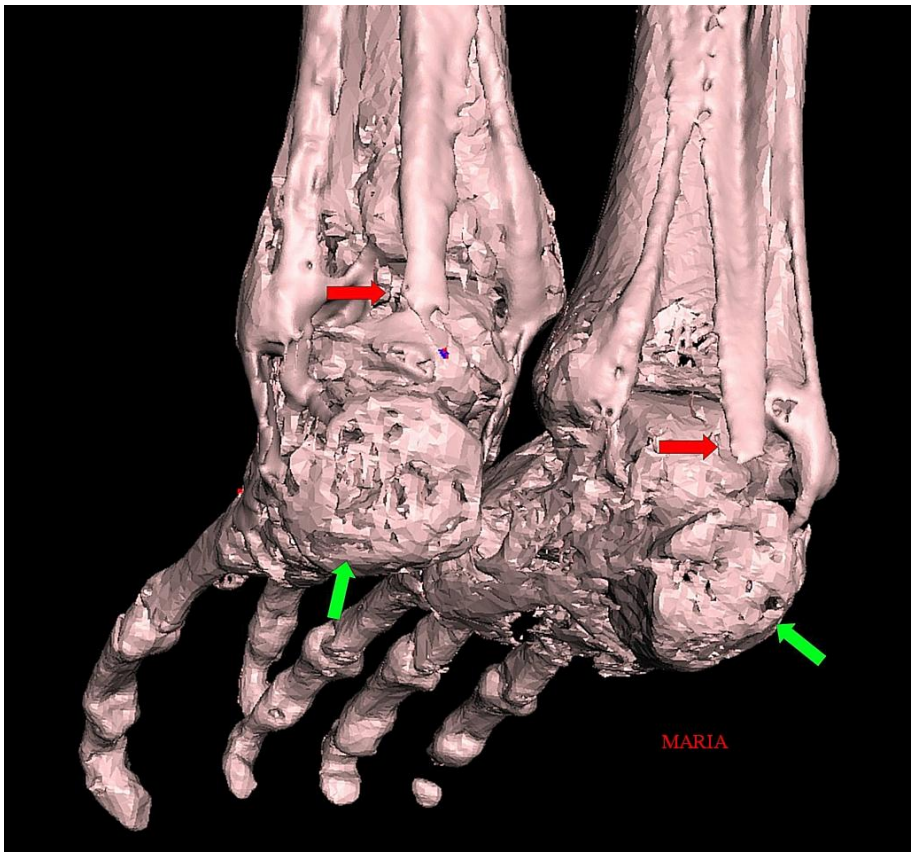

Figure 8: 3D CT showing both heels of ‘Maria’. Note the truncated appearance in posterior parts of bilateral calcanei (green arrows) and the cropped distal parts of bilateral Achilles tendons (red arrows).

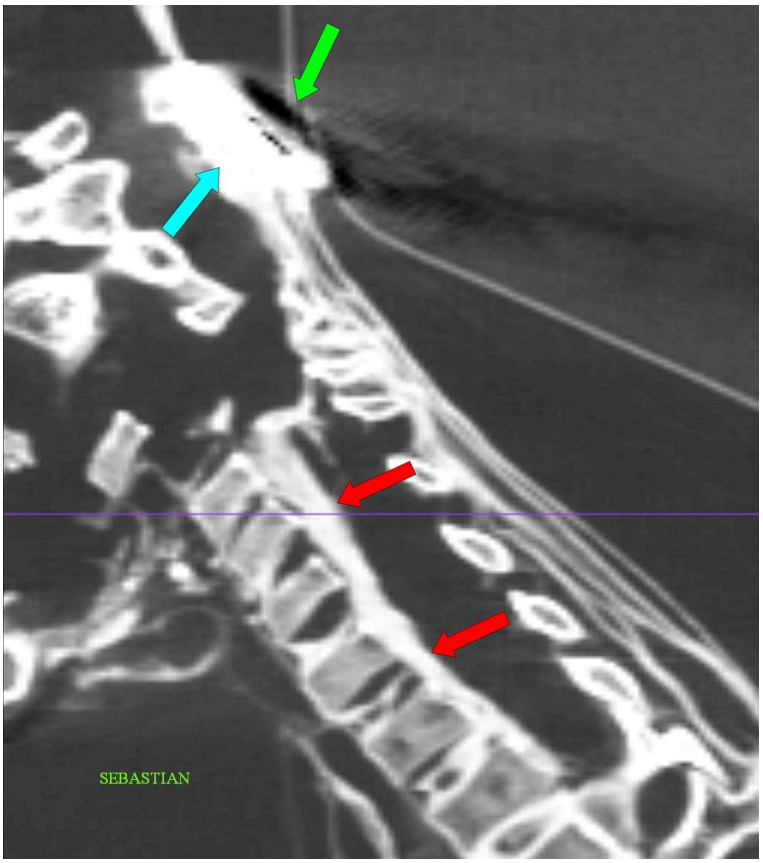

Figure 9: 2D sagittal CT scan of neck of ‘Sebastian’ showing epidural hematoma (red arrows) due to neck trauma. Metal implant (blue arrow) causing metal artefacts (green arrow) on CT was noted.

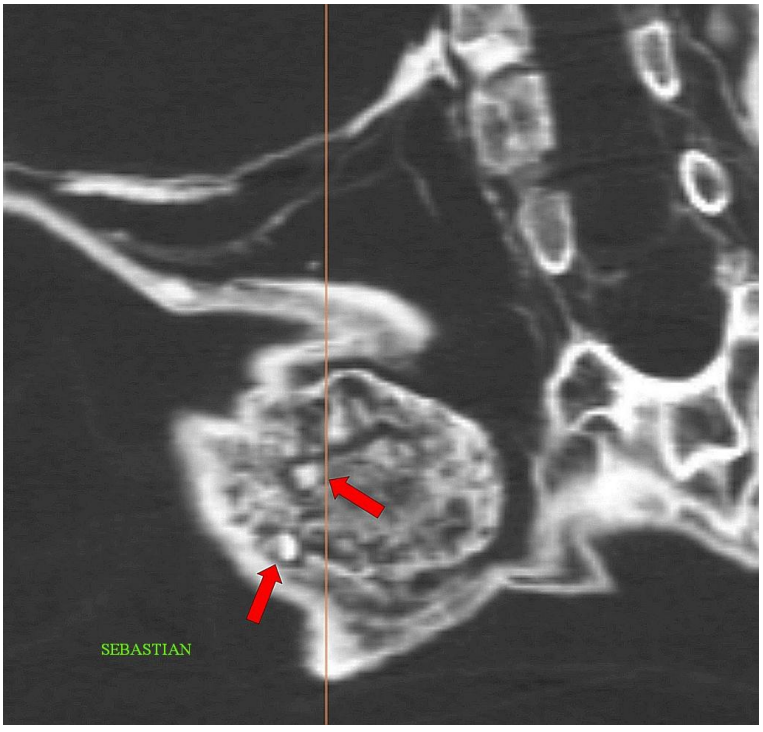

Figure 10: 2D coronal CT scan of abdomen in ‘Sebastian’ showing seeds (red arrows) within coprolites.

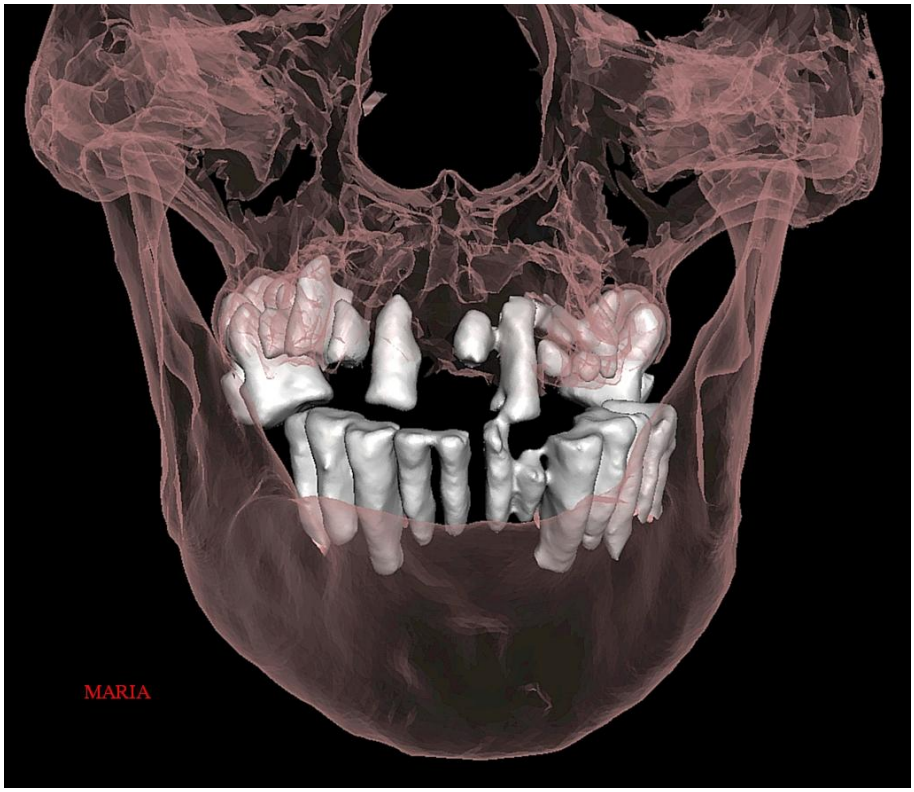

Figure 11: 3D CT showing poor dental condition with multiple broken teeth in ‘Maria’.

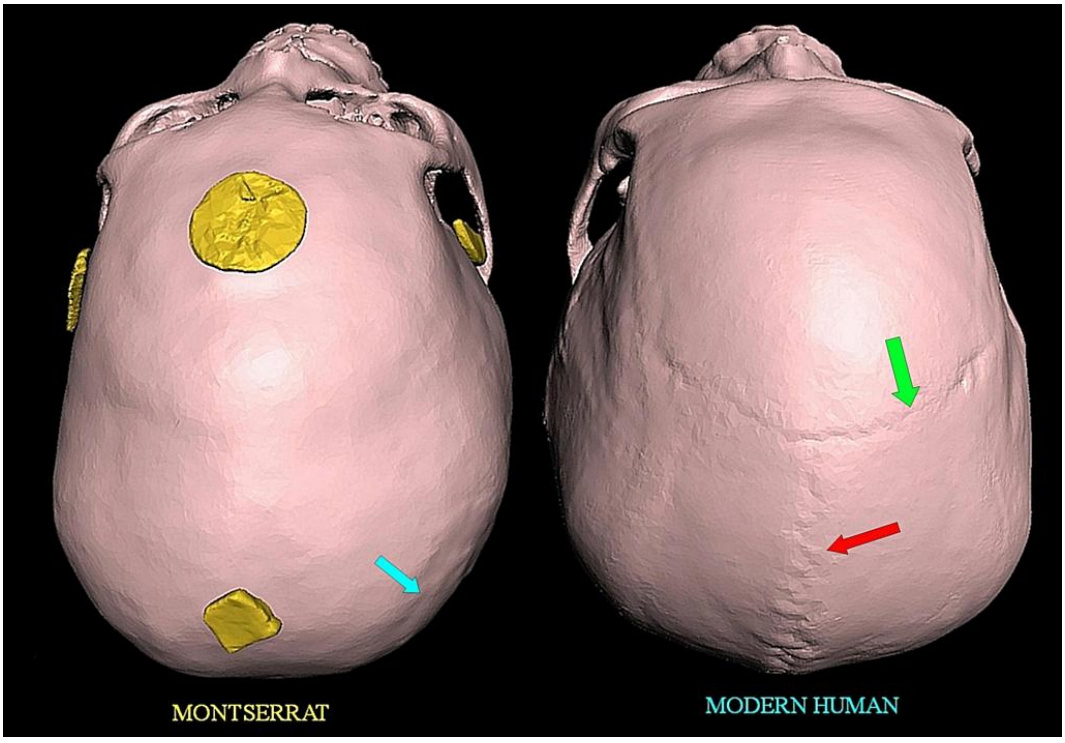

Figure 12: 3D CT top view of skull comparing ‘Montserrat’ with modern human. The sagittal suture (red arrow) and coronal suture (green arrow) cannot be seen on surface of ‘Montserrat’ skull. However, the lambdoid suture (blue arrow) can be identified.

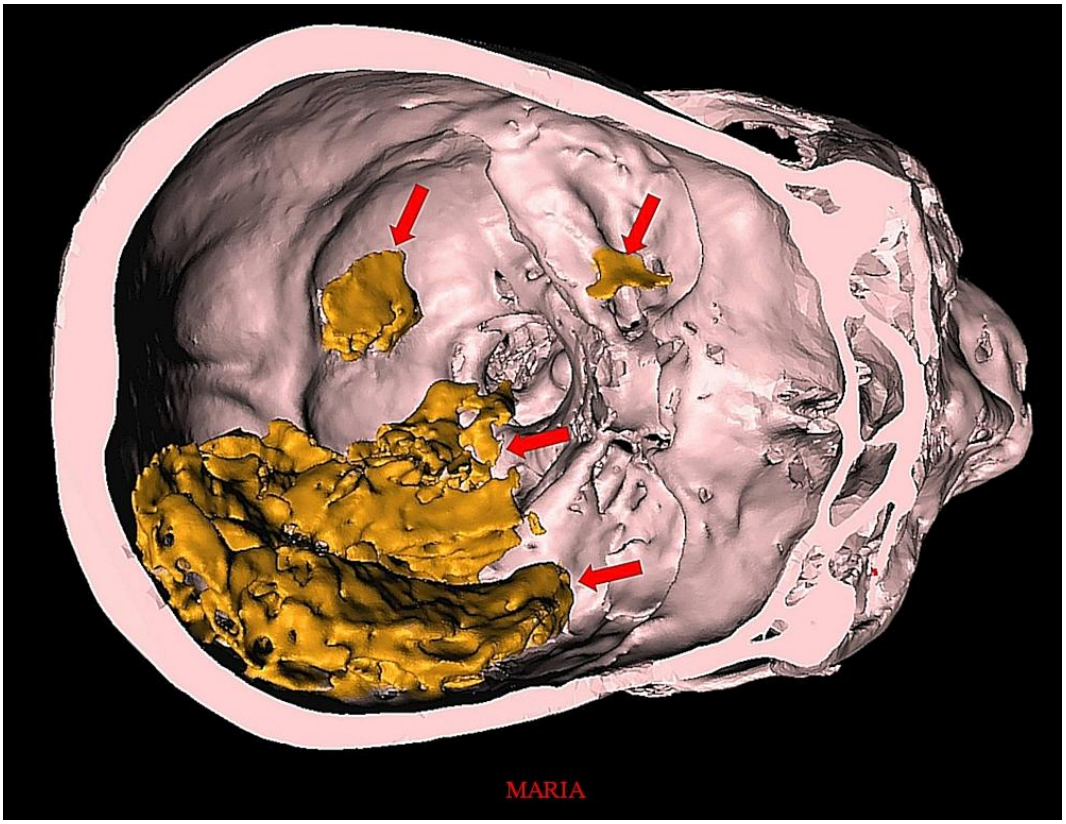

Figure 13: Cut section of 3D CT of skull of ‘Maria’ showing brain remnants (red arrow) within the cranial cavity. The major remnant retained the bi-lobed appearance.

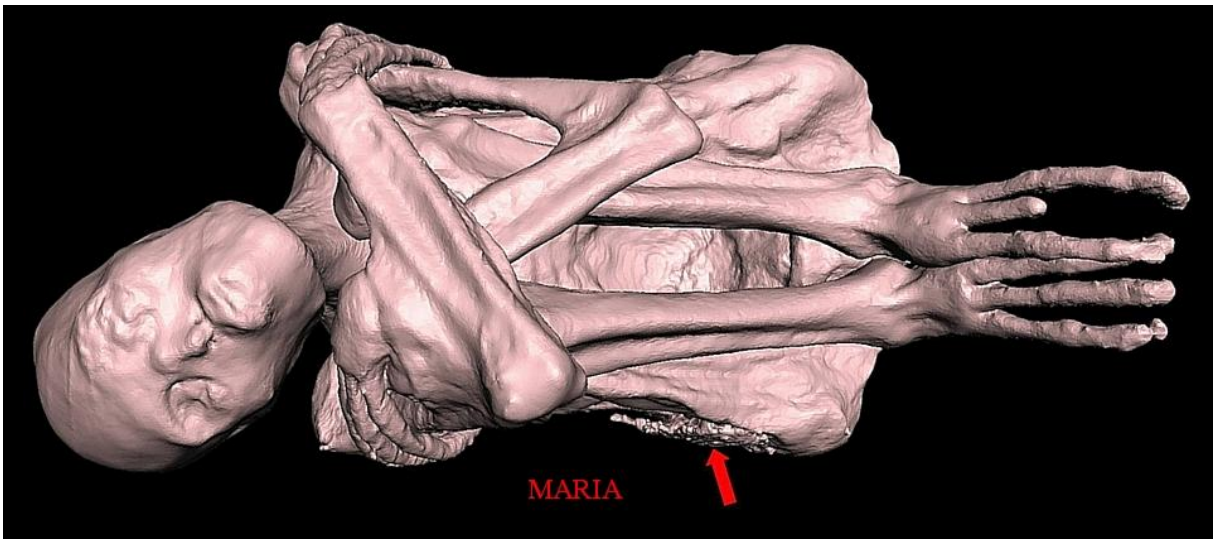

Figure 14: 3D CT showing ‘Maria’ in right side down decubitus position. Extraneous material (red arrow) was noted on right side of hip.

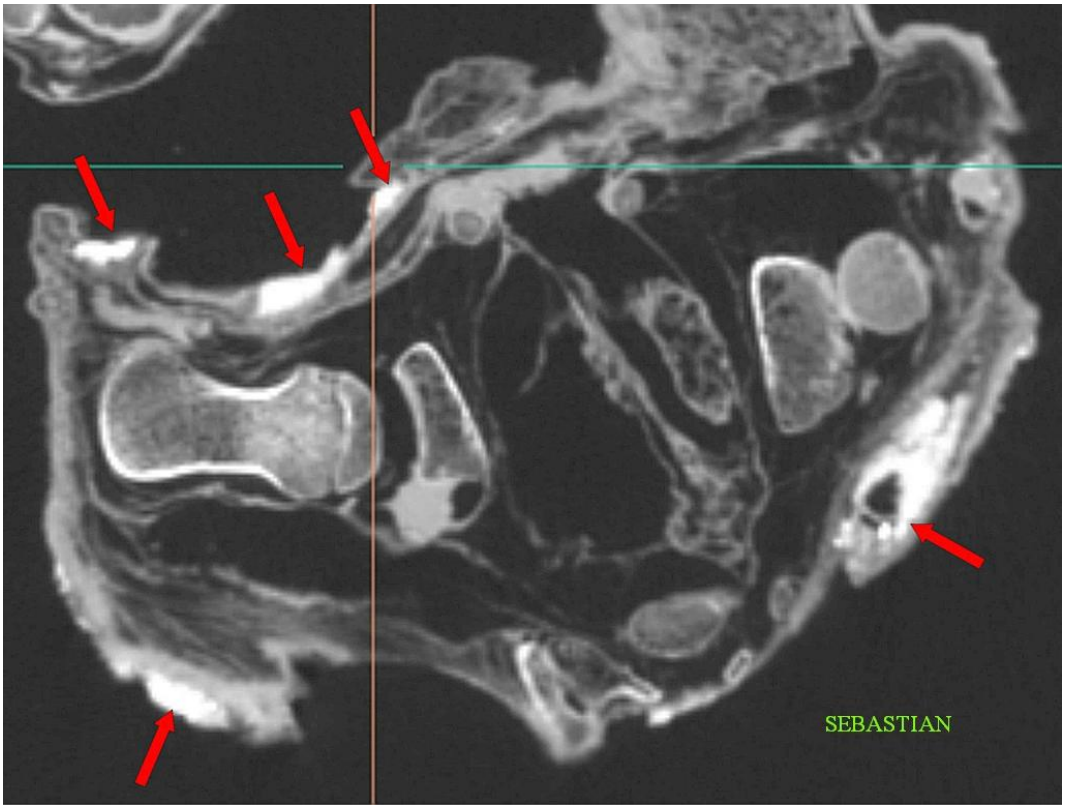

Figure 15: 2D axial CT scan showing extraneous substances (red arrows) on skin surface of ‘Sebastian’

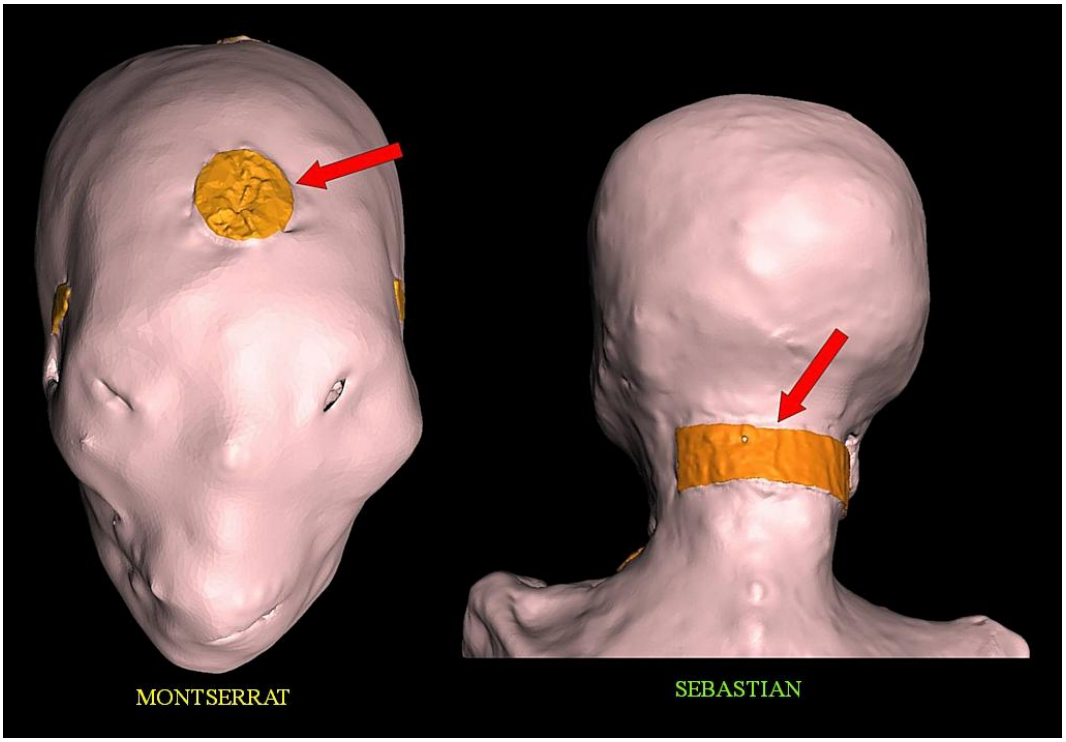

Figure 16: 3D CT showing presence of metallic implants (red arrows) that showed fusion with underlying tissue in ‘Montserrat’ and ‘Sebastian’.

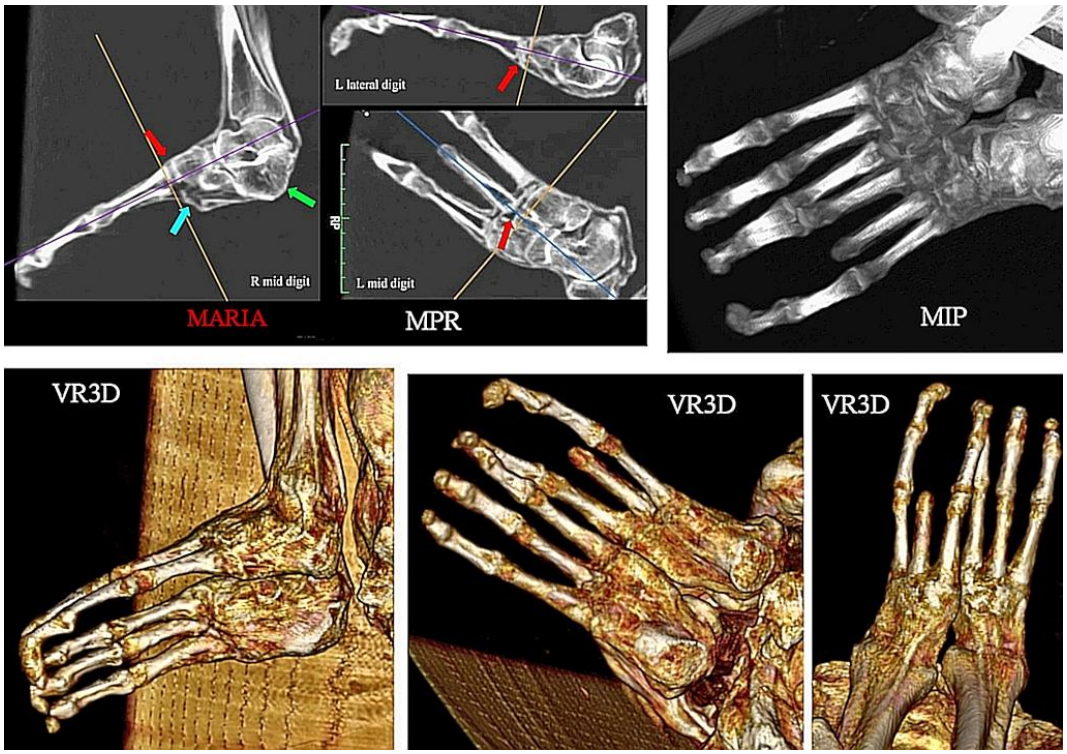

Figure 17: Feet of ‘Maria’. Various image processing techniques can be applied including multi-planar reconstruction (MPR), maximum intensity projection (MIP), volume-rendered 3D reconstruction (VR3D). Each technique has its own merit and limitations.

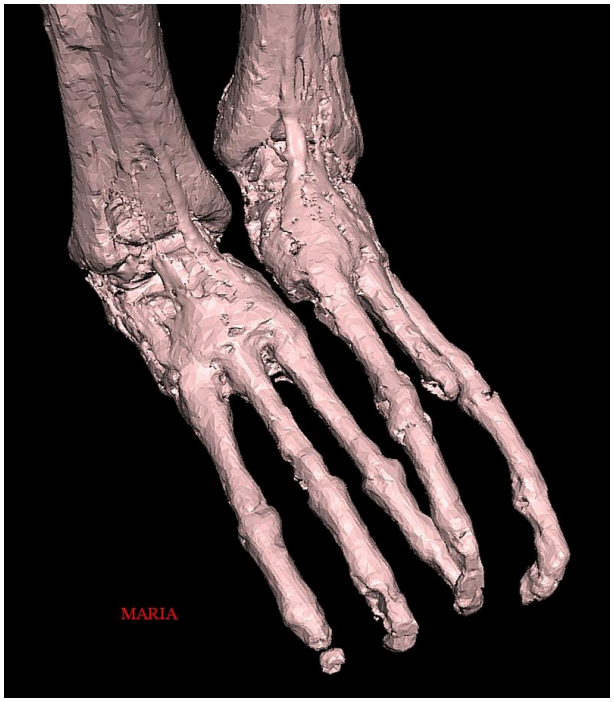

Figure 18: Shaded surface display (SSD) 3D CT reconstruction of both feet of ‘Maria’.

Figure 19: 3D CT of ‘Montserrat’ displayed in semi-translucency in false colours.

SECTION II: ANATOMICAL SIMILARITIES OF TRIDACTYLS WITH HUMAN

- **LONG BONES:** Similar anatomical features were observed. Pair bones including radius with ulna in forearm and tibia with fibula in leg were present. However, the relative proportions of long bones in relation to each other and in relationship to the torso required further study.
- **ELBOWS & KNEES:** similar joint arrangements. Patellae were present. (Figure 20)
- **SHOULDER GIRDLE:** clavicles, scapulae and shoulder joints were similar to human.
- **BOTH HIPS:** typical ball and socket joint arrangement between femoral heads and acetabulae were found. However, due to foetal posture of tridactyls, the hips were found to be hyperflexed.
- **SACRO-ILIAC JOINTS:** similar to human.
- **SKULL BASE:** similar division into anterior, middle and posterior cranial fossae can be found, Greater and lesser wings of sphenoid, dorsum sellae and pituitray fossae were comparable and similar. (Figure 21)
- **VASCULAR MARKINGS ON SKULL**: markings for middle meningeal vessels, superior sagittal and transverse sinuses on inner surface of skull (Figure 22) could be identified on Tridactyls, similar to human anatomy. In some Tridactyls, the superior sagittal sinus and falx cerebri were preserved and appeared similar to human. (Figure 23)
- **DENTAL STRUCTURES:** grossly similar. Dental caries and broken teeth can be found in Tridactyls. (Figure 24)
- **INTERNAL ORGANS:** most soft tissue in solid organs had disappeared and replaced by air, leaving perhaps connective tissue or fibrous tissue coverings in the Tridactyls. However, remnants of airways, bronchi, heart, major blood vessels (Figure 25), diaphragm, liver capsule, bowels, pelvic floor can be discerned and similar to human. Brain remnant showing bi-lobed configuration can be found in some Tridactyls. (Figure 13) Coprolites helped to outline bowel loops. (Figure 10)

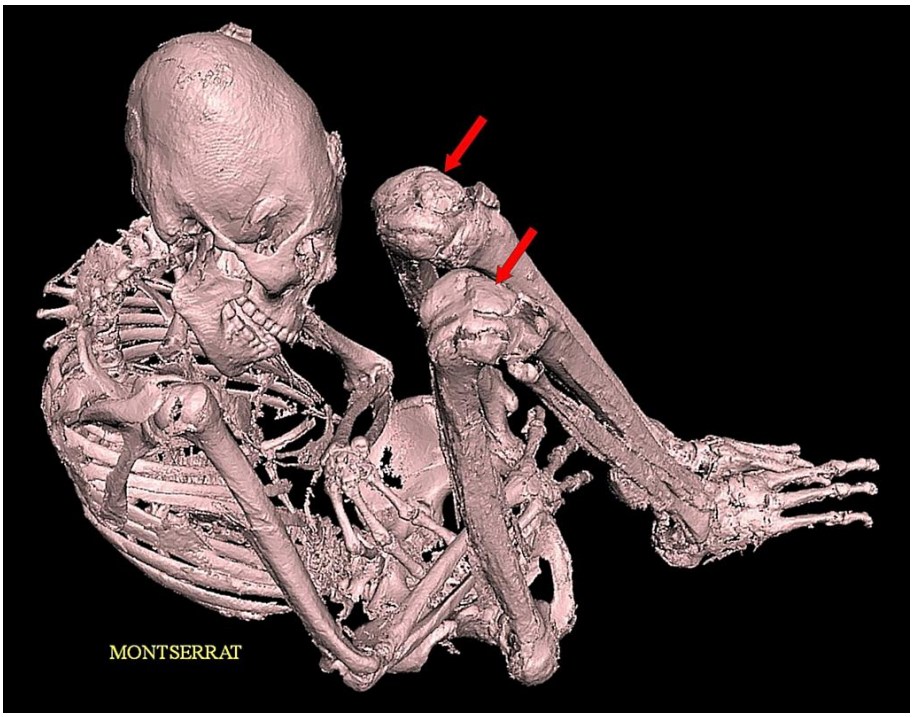

Figure 20: 3D CT showing bony skeleton of ‘Montserrat’. Patellae (red arrows) similar to human were present.

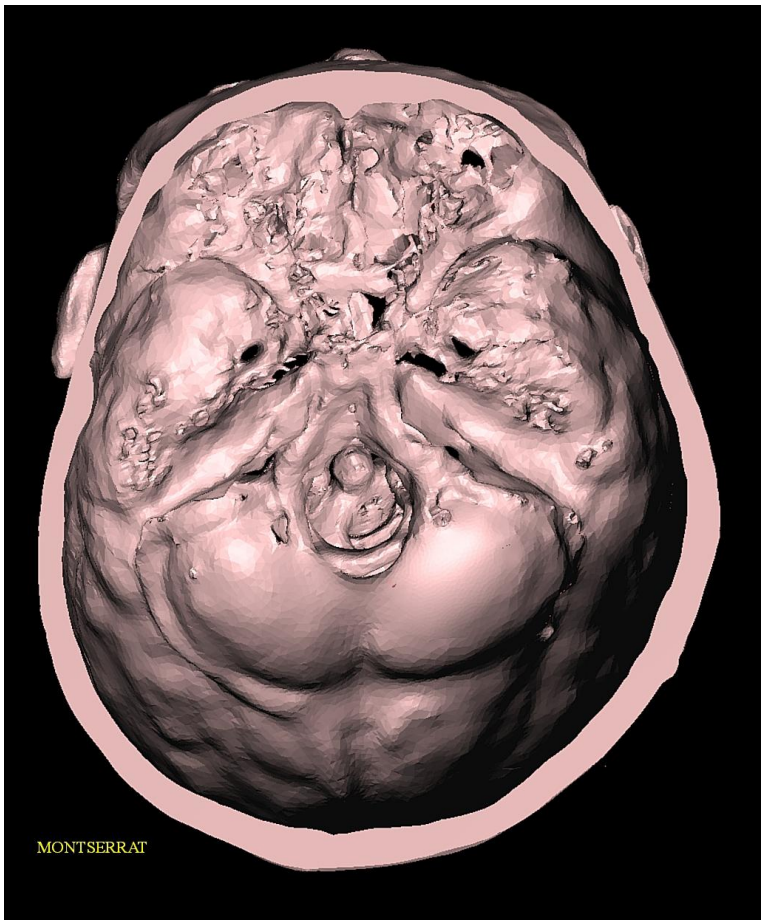

Figure 21: 3D CT showing skull base of ‘Montserrat’. Note the elongated and distorted skull with small shallow anterior cranial fossa.

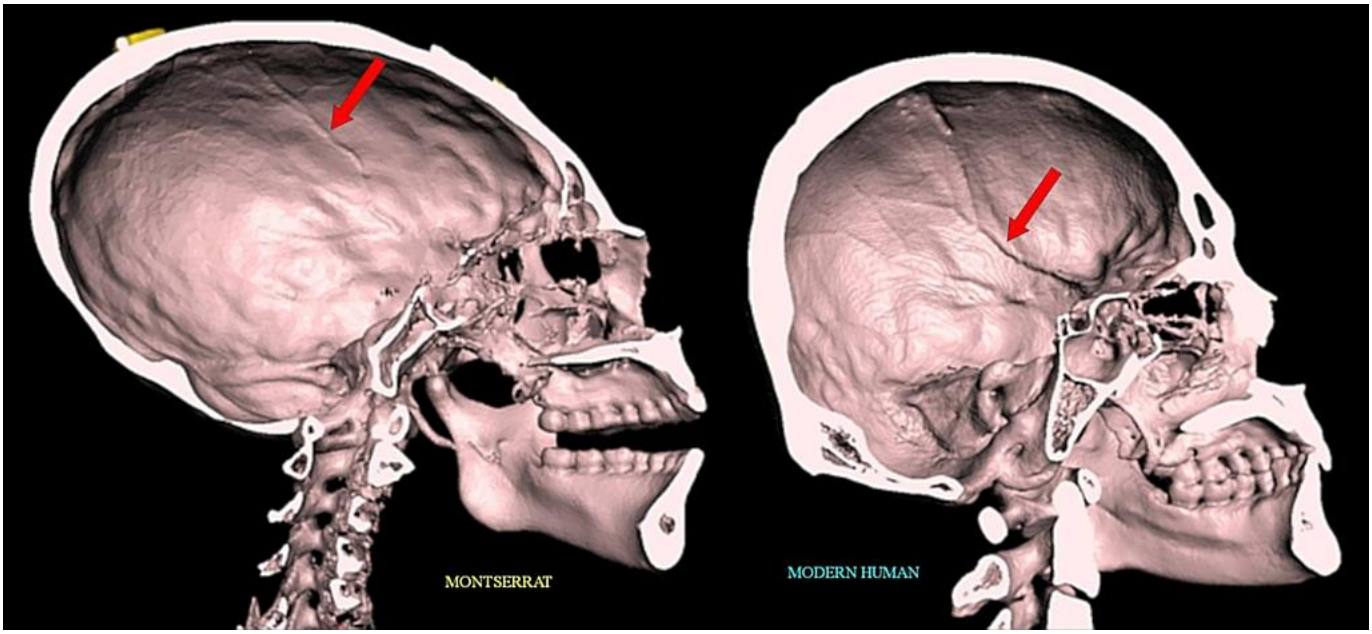

Figure 22: 3D CT sagittal cut section of 'Montserrat' and modern human skull showing vascular markings for middle meningeal vessels (red arrows).

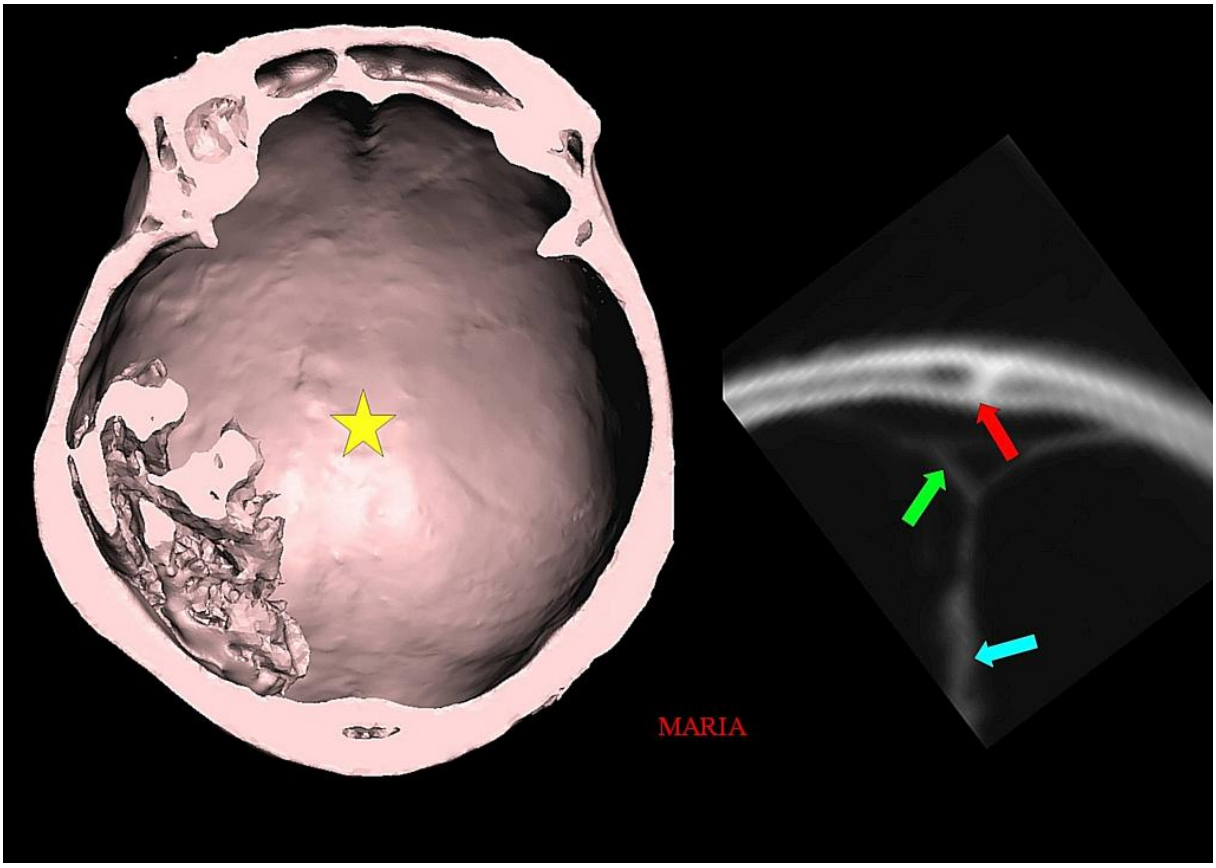

Figure 23: 3D CT (left) of skull vault of 'Maria' showing smooth surface in inner table of the skull with no visible sagittal suture (expected location marked by yellow star). Brain remnant was found on right side. On 2D coronal CT scan (right), fused sagittal suture (red arrow) could be identified with continuous inner and outer tables of skull. The superior sagittal sinus (green arrow) and falx cerebri (blue arrow) could also be identified.

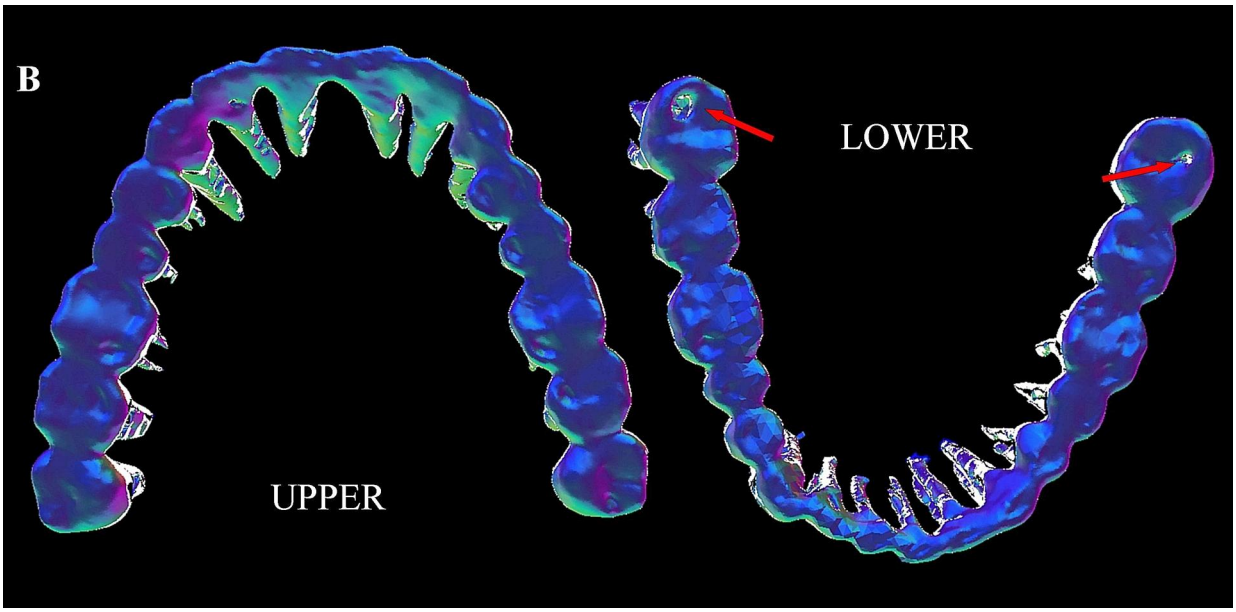

Figure 24: 3D CT showing upper and lower sets of teeth in ‘Montserrat’. Dental caries are noted (red arrows).

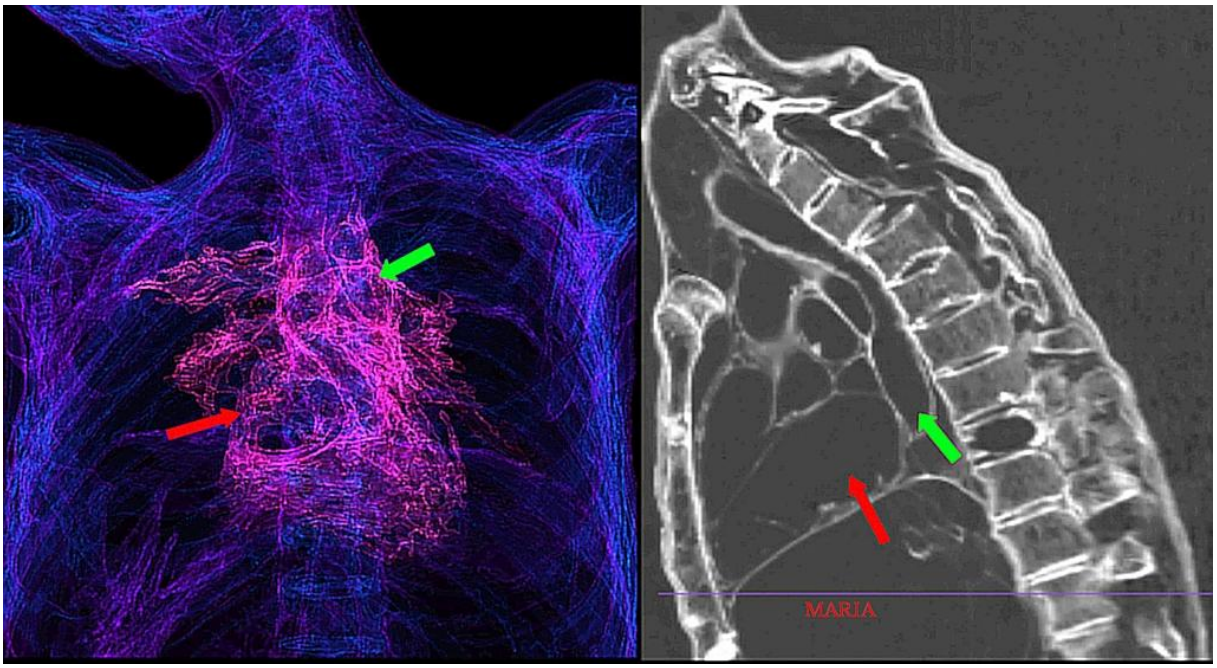

Figure 25: 3D CT (left) showing heart and great vessels within the thorax of ‘Maria’. Sagittal 2D CT scan (right) showing cardiac chambers (red arrow) and aorta (green arrow).

SECTION III: ANATOMICAL DIFFERENCES OF TRIDACTYLS WITH HUMAN

- **SKULL:** Early fusion of sagittal and coronal sutures were noted so that they cannot be identified on inner and outer surfaces of the cranium. (Figures 12,22,23) Lambdoid suture was identifiable. (Figure 26) Variable degree of elongation of the skull mainly in posterior direction was noted. (Figure 29) The frontal bones were elongated and sloping. Vascular markings for middle meningeal vessels were similarly affected. The vertex was located more posteriorly and higher. The skull vault was relatively smooth and symmetrical with no abrupt transition was observed (Figure 27) making it unlikely to be due to artificial cranial deformation.
- **FORAMEN MAGNUM:** Foramen magnum may be elongated posteriorly e.g. in 'Sebastian' but this is a variable finding. (Figure 28)
- **ORBITS:** In tridactyls, the orbits were large, rounded and sloping following the shape of the frontal bones and were more widely separated. The eyelids were large and slanting outwards in 'Montserrat' and 'Sebastian' (Figures 1,2,5,14) although relatively small in 'Maria'. (Figure 16)
- **CRANIO-FACIAL:** The tridactyls showed variable sloping facial bones and small maxillary sinuses. (Figures 29,30,31,32)
- **NOSE:** 'Maria' showed small nose deviated towards the right side with 2 small nostrils. 'Montserrat' showed absence of nostrils with very small nose. 'Sebastian' showed absent nose with 2 slit-like nostrils opening medially and inferiorly. (Figures 30,31) With some variation in relative size e.g. relatively enlarged inferior nasal cavity, the anatomy of paranasal sinuses and nasal turbinates were essentially similar to human.
- **ABSENCE OF PINNAE:** Pinnae (external ears) were all absent in 'Maria', 'Montserrat' and 'Sebastian'. The opening of the external auditory canal showed variable appearance and may be partially or completely closed externally. (Figure 32) However, contrary to human genetic defects, no associated atresia of external auditory canal was found. Ear ossicles, cochlea and internal auditory canals could be identified. (Figure 33)
- **ECTOPIC TOOTH:** Ectopic tooth was found on anterior surface of left maxillary bone in 'Sebastian', a location extremely rare for ectopic tooth to be found in human. (Figure 34)
- **JAWS**: prominent protruding small jaws were noted. The neck of mandibles were elongated resulting in increase obtuse angle of mandible. (Figures 22,27,29)
- **COSTAL CARTILAGES:** Prominent, densely calcified and variably distorted costal cartilages were noted associated with depressed lower sternum (pectus excavatum). (Figure 5,35)
- **ABDOMINAL WALL**: Prominent fold was noted in anterior midline in abdomen and pelvis with focal bulging in lower abdomen. The umbilicus cannot be identified. (Figure 36)

SECTION III: ANATOMICAL DIFFERENCES OF TRIDACTYLS WITH HUMAN *(continued 2)*

- **UTERUS:** Pregnant uterus containing mid term foetus was located in right side of abdomen in 'Montserrat'. (Figure 4) In human the pregnant uterus should be located in midline.
- **PERINEUM**: a relatively flat triangular surface can be found joining bilateral ischial tuberosities with the symphysis pubis. (Figure 37) The pubic area appeared to be elongated vertically. A small midline pointed structure could be found projecting anteriorly from pubic area suggestive of a phallus or equivalent. (Figure 37) Lack of buttock prominences nor cleft-like appearance in perineum was noted in the Tridactyls.
- **INTERVERTEBRAL DISKS**: 'Maria' and 'Montserrat' showed intervertebral disks resembling human but 'Sebastian' showed diffuse hyperdense intervertebral disks involving thoracic, lumbar and sacral spine but sparing cervical spine. (Figure 38) Calcified intervertebral disks are rare in paediatric age group in human and tends to be focal, mostly in cervical spine. The specific pattern of involvement in 'Sebastian' and other child mummies including'Santiago' and 'Wawita' were quite unique features of Tridactyl mummies.
- **COCCYX**: Coccyx was not identified in 'Montserrat' but could be identified in 'Sebastian'. (Figure 39) In 'Maria' due to tissue and bone loss from trauma in sacral area, coccyx cannot be found.
- **HANDS AND WRISTS:** Well spaced tridactyls arrangement showing 3 long digits originating from carpal bones in wrist directly without evidence of palm was noted. (Figure 40) For each digits in the hands, 5 segments with joints in between were noted. The carpal bones were relatively small but well articulated without evidence of manipulation nor intervention. Flexor and extensor tendons of digits were intact. In human, the finger bones show gradual decrease in sizes further distally but in Tridactyls such pattern was not observed. All bones were more slender with less robust bony prominences. (Figure 41) The digits appeared to be highly flexible curving around the arms whilst in the foetal posture. (Figure 42)

SECTION III: ANATOMICAL DIFFERENCES OF TRIDACTYLS WITH HUMAN *(continued 3)*

- **FEET AND ANKLES:** The ankle joints were similar to human with talus articulating with tibia. Anterior and posterior tibial tendons and peroneal tendons could be identified similar to human. (Figure 43) Maria showed exceptional short calcanei bilaterally that appeared to have been truncated posteriorly with thin covering bone and soft tissue. This was associated with truncated distal part of Achilles tendons and their insertions into calcanei. (Figure 44) Apart from that, calcanei in 'Montserrat' and 'Sebastian' were similar to human. Tridactyl with 3 equally spaced individual long digits originating directly from tarsal bones with lack of metatarsals were noted. 4 segments were noted in each digit but joints between distal digits may be fused and showed claw shaped appearance distally. The digits were well aligned with the tarsal bones. (Figure 45) Plantar fascia appeared narrow and cord-like instead of sheet like in human. (Figure 46) Ligaments attached to digits were intact. Thick soft tissue was noted beneath both feet with sharp transition to the thinned soft tissue underneath the digits. Plantar arch was present but variable. (Figure 47) Bones were relatively more slender compared with human. The medial digits in feet of 'Sebastian' were more robust compared with other digits. (Figure 6) Digits in 'Maria' and 'Montserrat' were of similar sizes. Soft tissue contact pads were noted in plantar aspects of digits in both feet. (Figure 48)

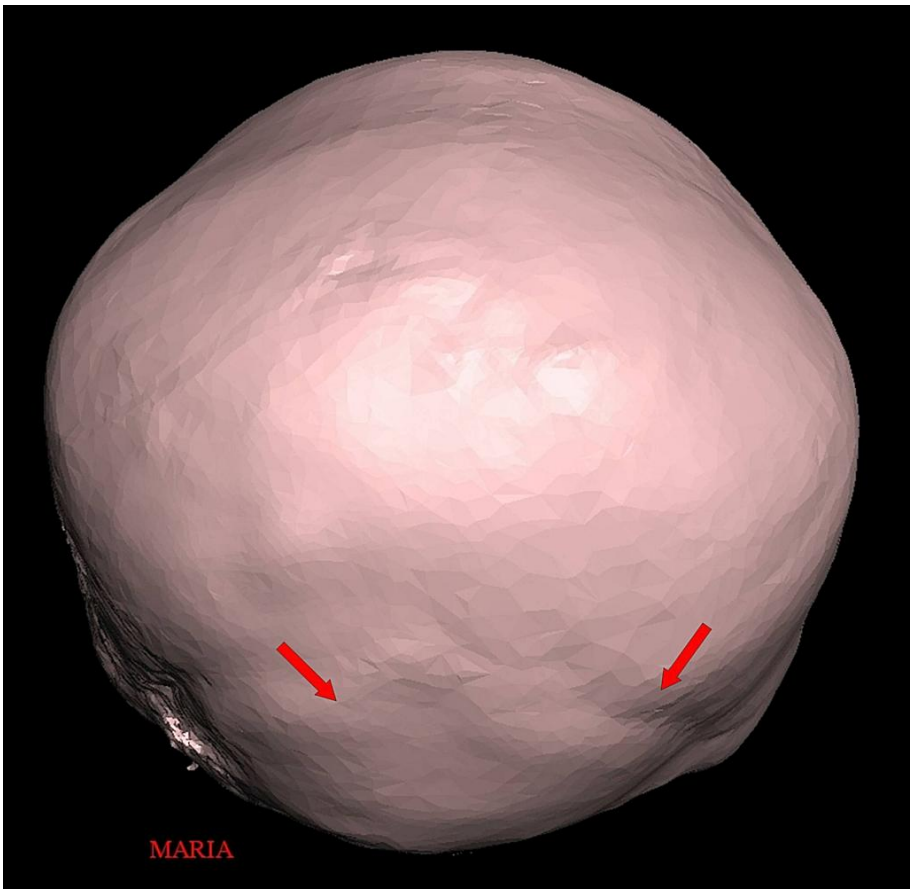

Figure 26: 3D CT showing back of head of ‘Maria’. The lambdoid suture can be identified (red arrows).

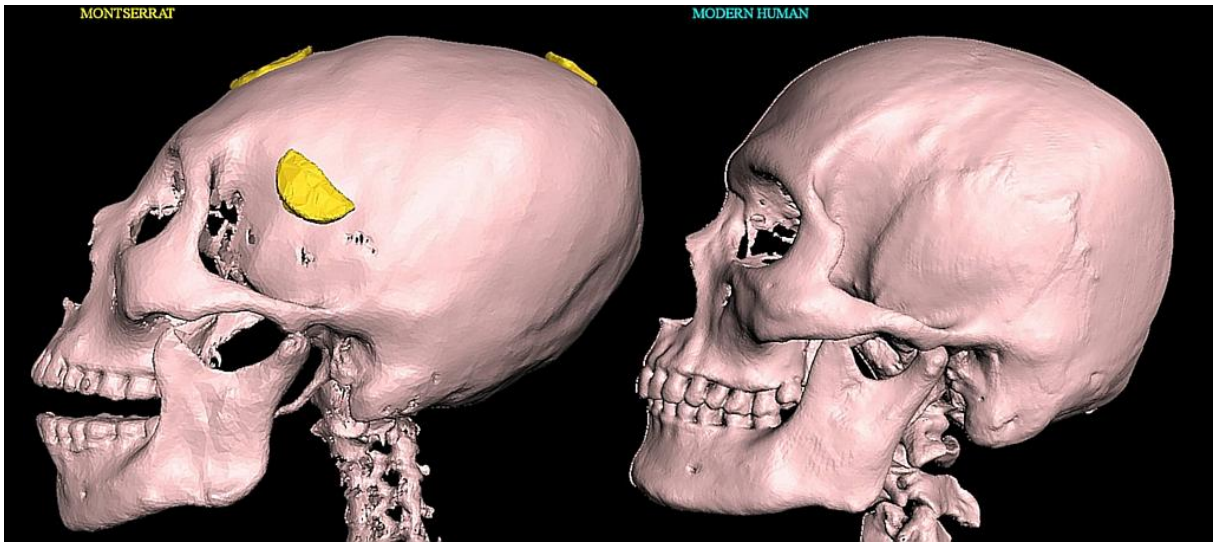

Figure 27: 3D CT comparing skull of ‘Montserrat’ against a modern human skull. Note the elongated skull, shifted vertex, lack of most cranial sutures, sloping forehead, sloping orbits, sloping face, anteriorly shifted maxilla and mandible in ‘Montserrat’.

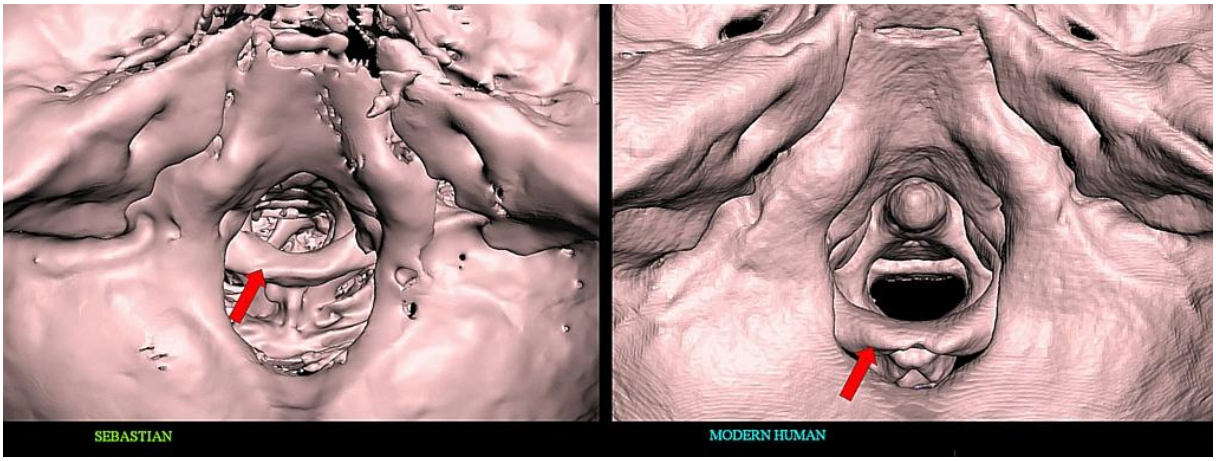

Figure 28: 3D CT inner view of foramen magnum of ‘Sebastian’ compared with modern human. The foramen magnum in ‘Sebastian’ appeared to be elongated posteriorly. The arch of atlas (red arrows) was found in the middle of foramen magnum, whereas in human the arch of atlas was located posteriorly.

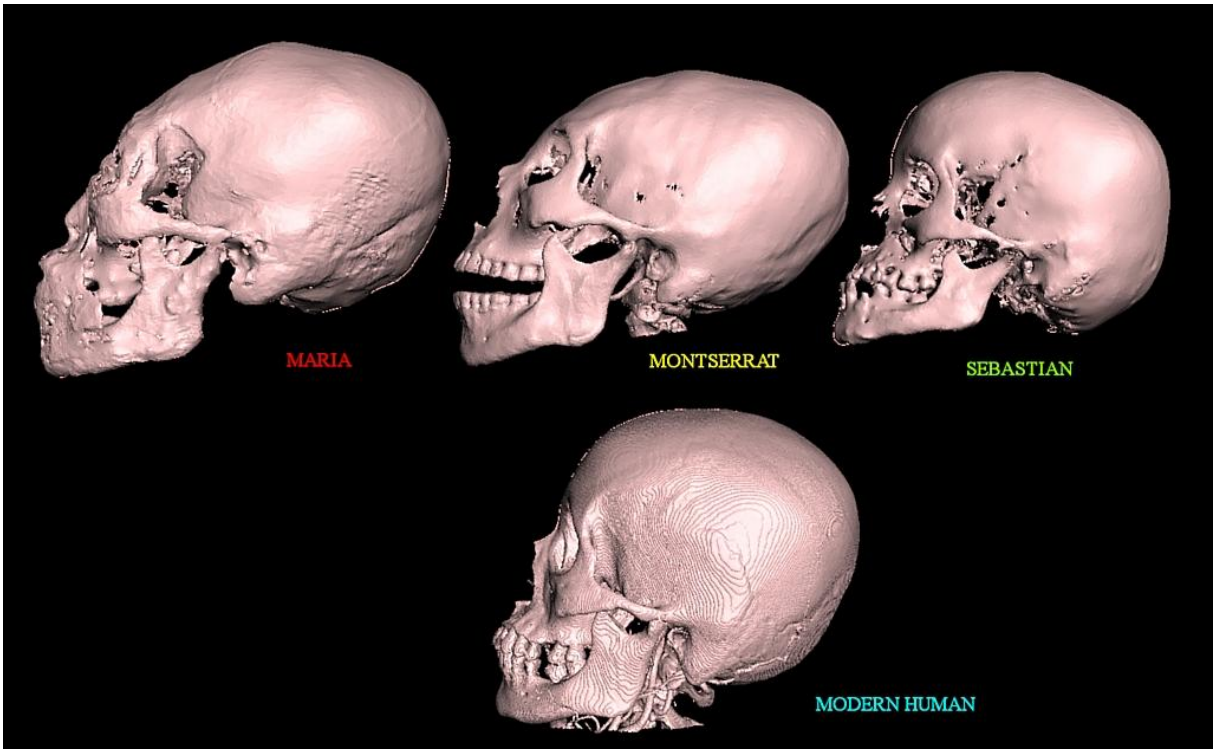

Figure 29: 3D CT showing skulls of ‘Maria’, ‘Montserrat’ and ‘Sebastian’ comparing with modern human skull. ‘Montserrat’ showed most prominent elongated skull. Both ‘Maria’ and ‘Montserrat’ showed sloping cranio-facial features. ‘Sebastian’ showed rounded head with small depressed facial bones.

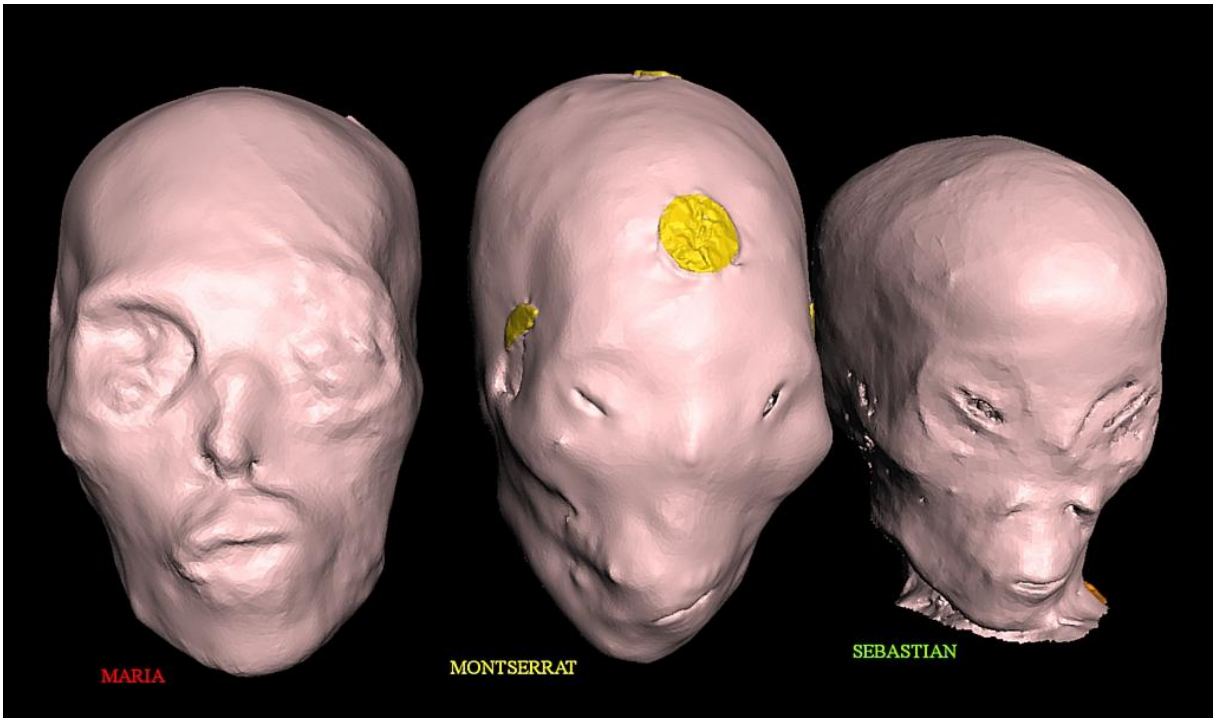

Figure 30: 3D CT showing nose features in 3 tridactyls. Note the small narrow nose of ‘Maria’ deviated towards the right with small nostrils. ‘Montserrat’ completely lacked nostrils. Slit-like obliquely oriented nostrils with absence of protruding nose were noted in ‘Sebastian’.

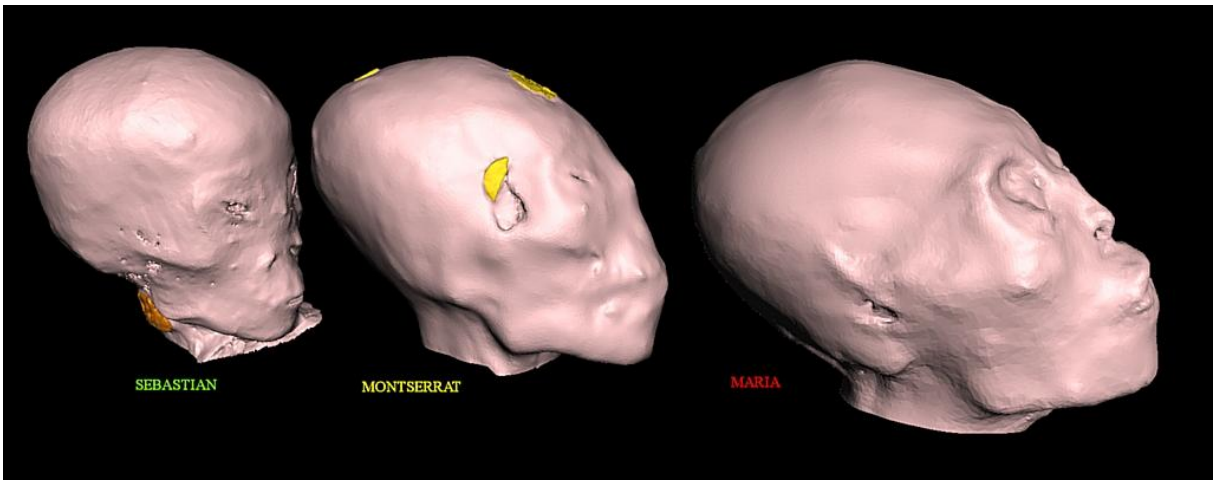

Figure 31: 3D CT side of nose in tridactyls.

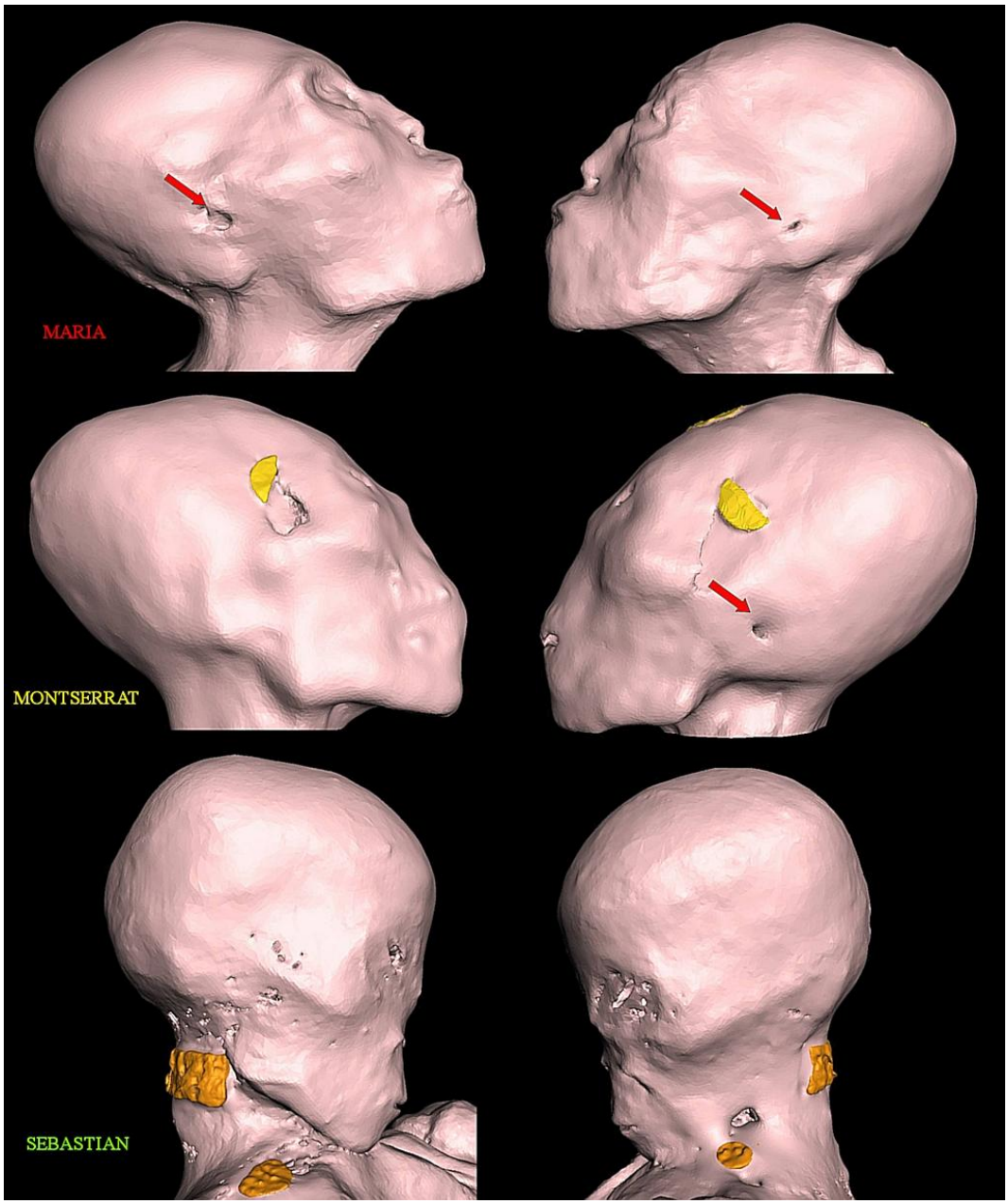

Figure 32: 3D CT showing absence of external ear (pinnae) in all 3 tridactyls. External opening of ear canal (red arrows) was not found on right side of ‘Montserrat’ nor in ‘Sebastian’ bilaterally.

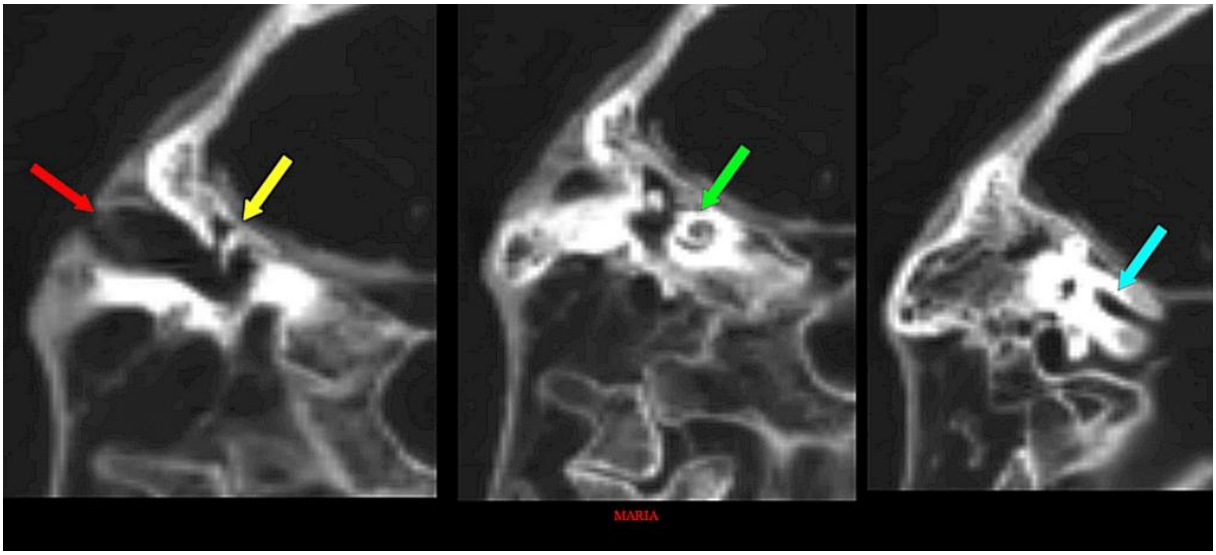

Figure 33: 2D coronal CT scans of internal structure of right ear in ‘Maria’. Note normal size of external auditory meatus despite narrowing at its opening (red arrow). Ear ossicles (yellow arrow), cochlea (green arrow) and internal auditory canal (blue arrow) were same as human.

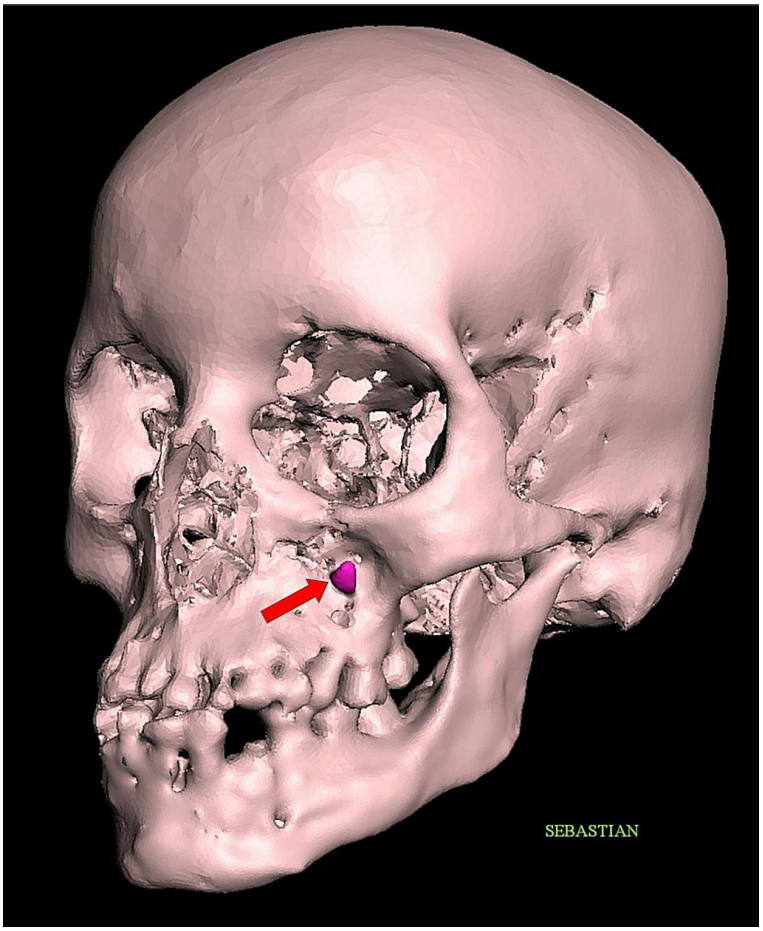

Figure 34: 3D CT of ‘Sebastian’ showing exceptionally rare location for ectopic tooth on anterior surface of left maxillary bone (red arrow).

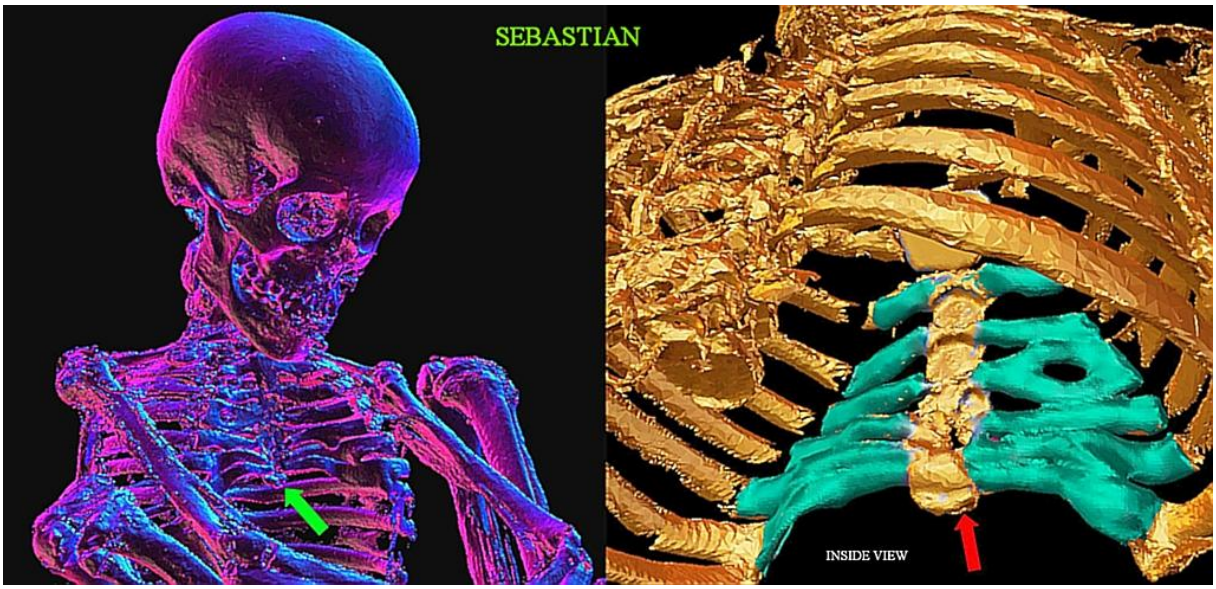

Figure 35: 3D CT showing depressed sternum (pectus excavatum) in 'Sebastian' with thick calcified irregular calcified cartilages unlike that seen in human. Red arrow and green arrow point to xiphisternum.

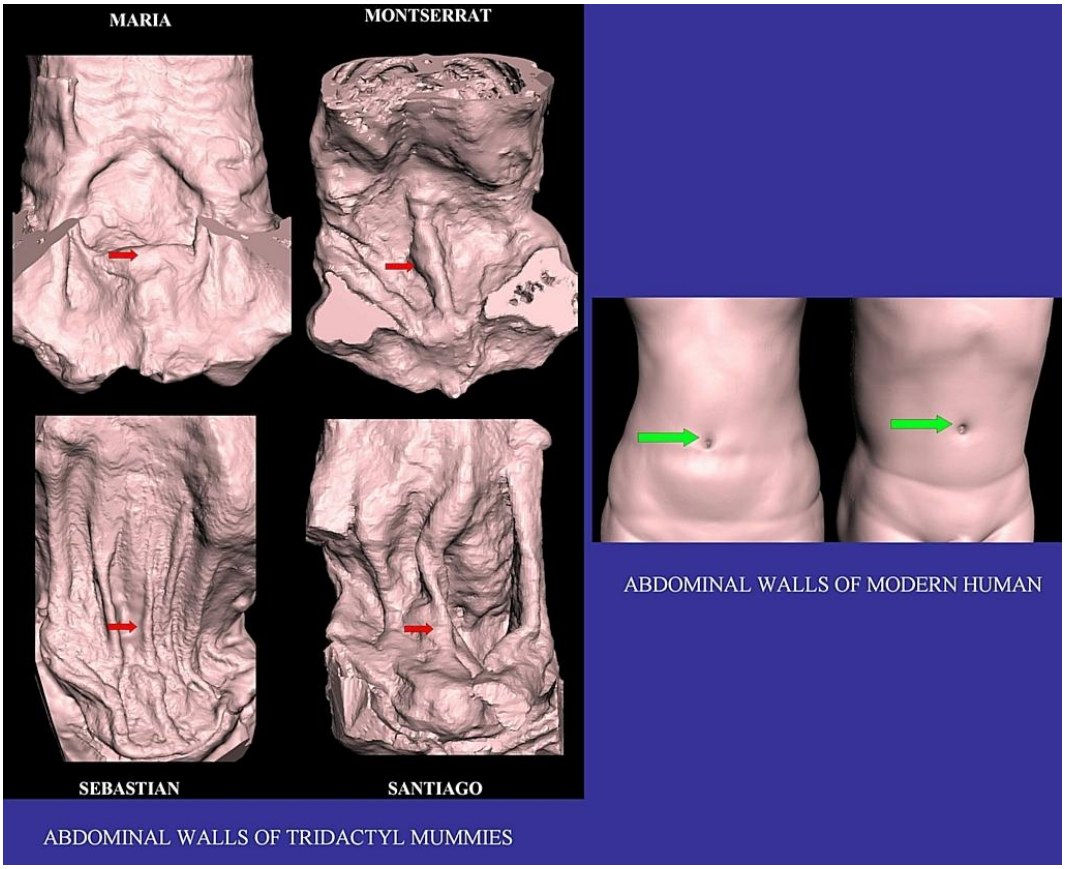

Figure 36: 3D CT of tridactyl mummies compared with human. Note central prominent abdominal fold with fold bulging and lack of umbilicus (expected position indicated by red arrows) in tridactyls.

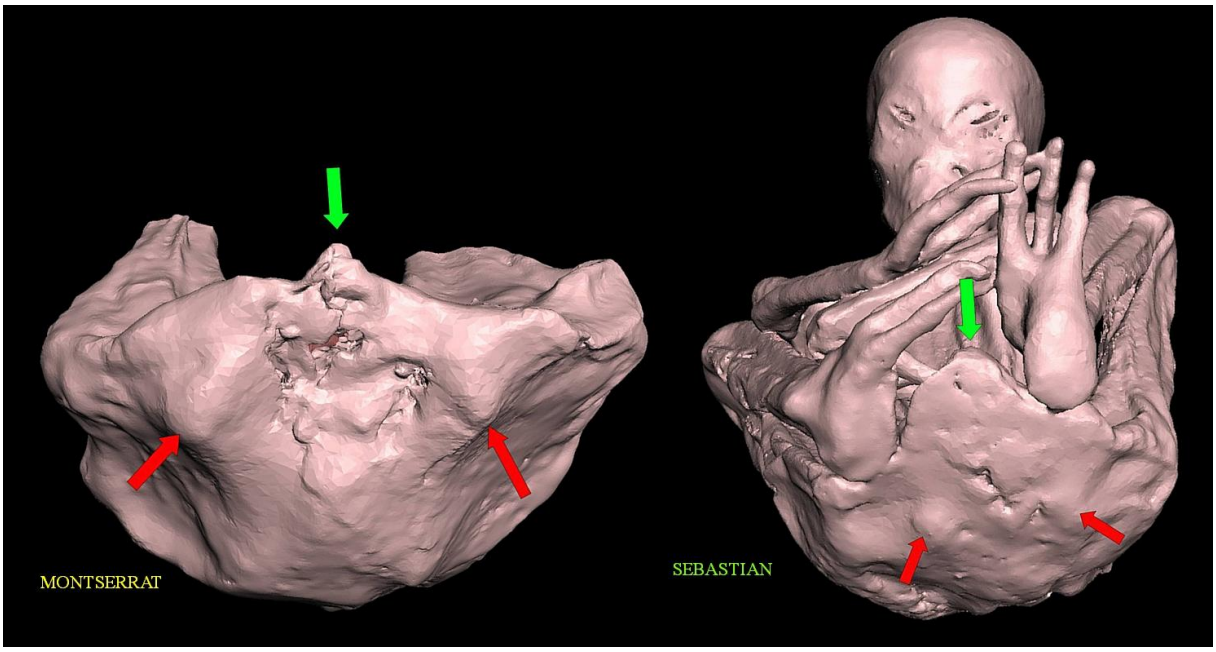

Figure 37: 3D CT showing perineum of ‘Montserrat’ and ‘Sebastian’. Note the flat triangular shaped perineum between the ischial tuberosities (red arrows) and the pointed anterior structure (green arrow) suggestive of phallus. Perineum in ‘Maria’ was defective due to trauma.

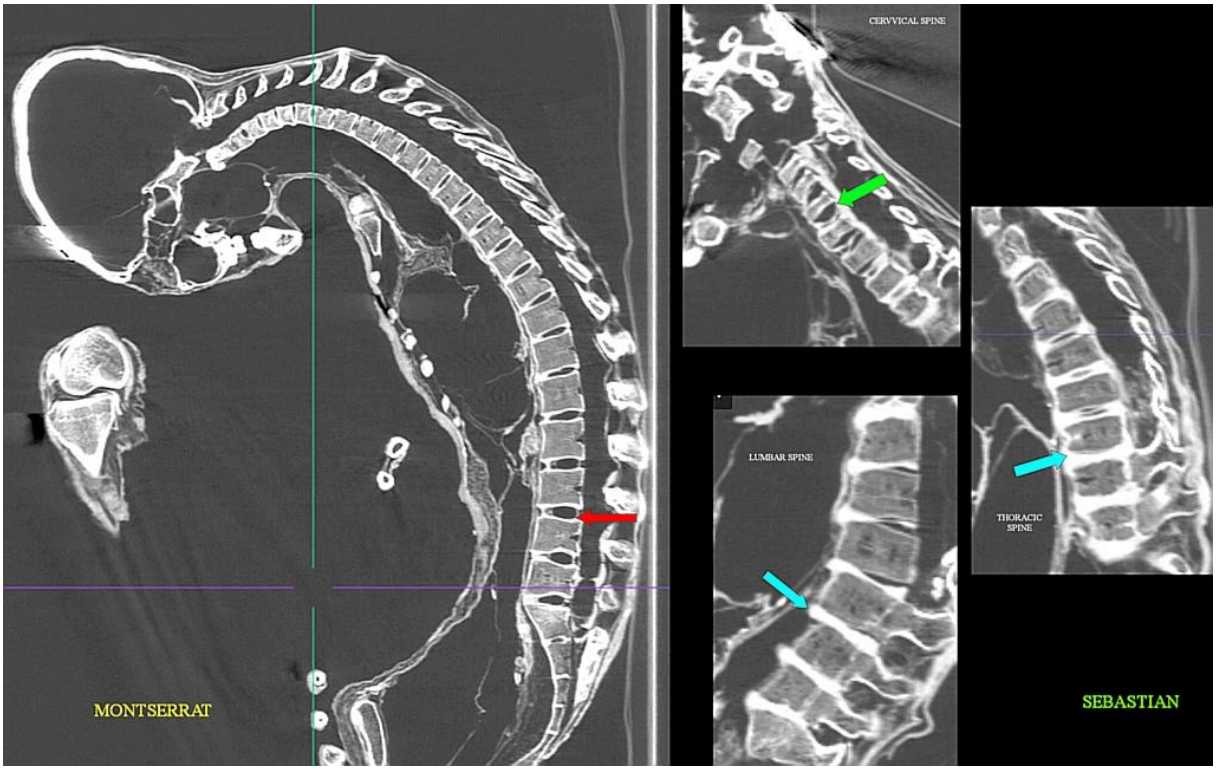

Figure 38: 2D sagittal CT scan of spine of ‘Montserrat’ (left) and spine of ‘Sebastian’ (right). Intervertebral disks (red arrow) in ‘Montserrat’ were hypodense resembled human spine. However in ‘Sebastian’ the cervical intervertebral disks (green arrow) was hypodense but the intervertebral disks in thoracic and lumbar spine (blue arrows) were hyperdense suggesting that they were heavily calcified, a unique feature not seen in human.

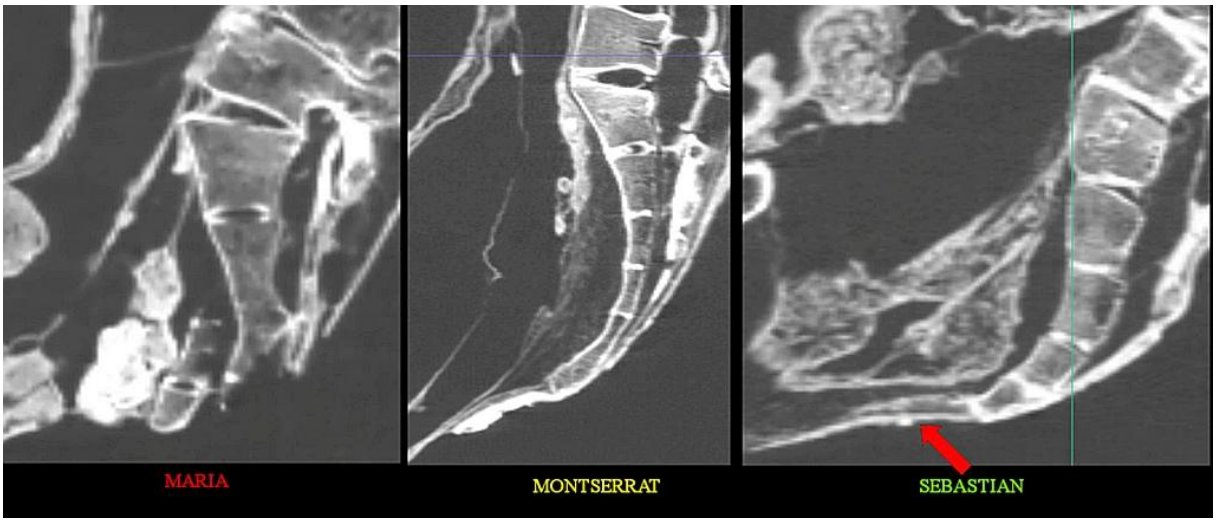

Figure 39: 2D sagittal CT scan of sacral spine showing lack of coccyx beyond the last segment of sacrum in ‘Montserrat’. Coccyx (red arrow) can be identified in ‘Sebastian’. In ‘Maria’ sacrum was fractured with anteriorly displaced distal sacral segment. Coccyx cannot be identified.

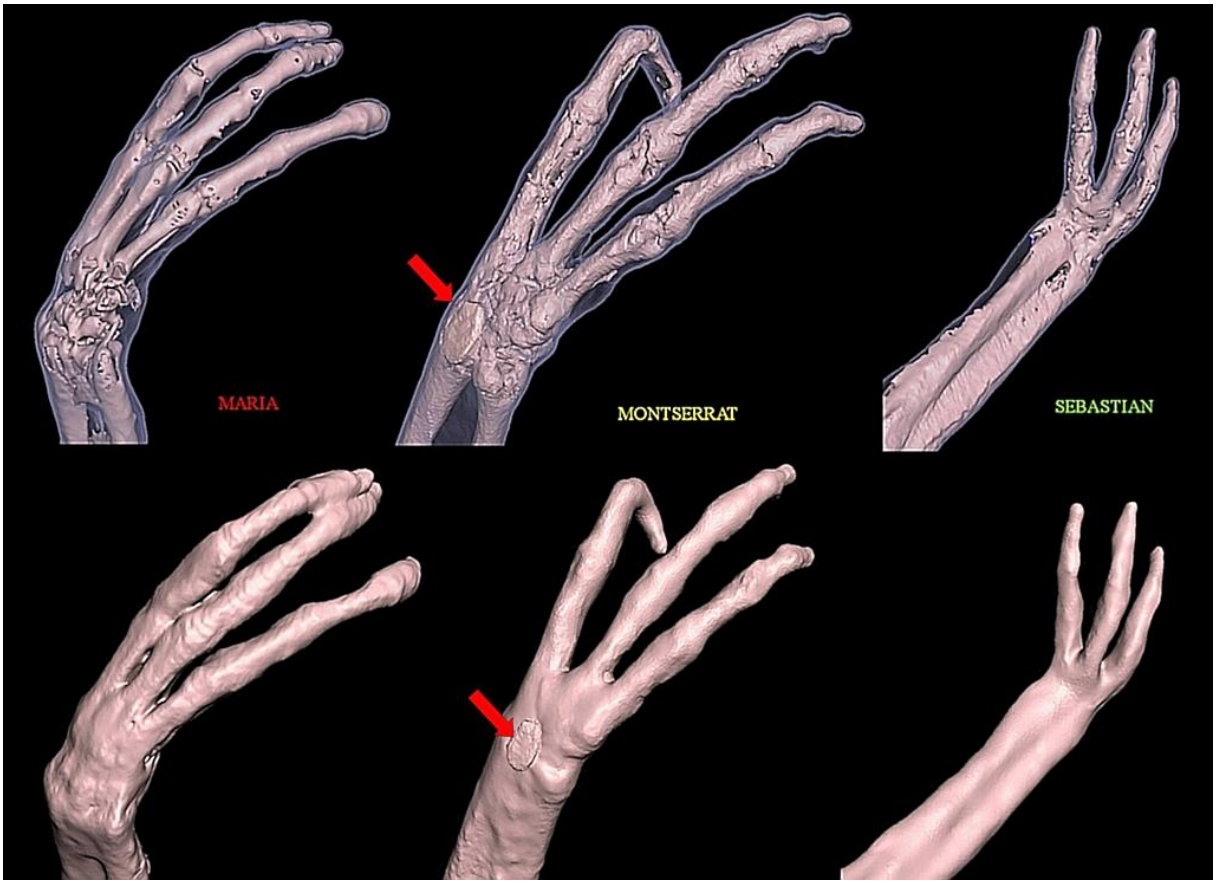

Figure 40: 3D CT right hand of ‘Maria’, ‘Montserrat’ and ‘Sebastian’. Upper images show bones through transparent skin; lower images show appearance of skin. Note an oval shaped metal implant (red arrow) on wrist of ‘Montserrat’.

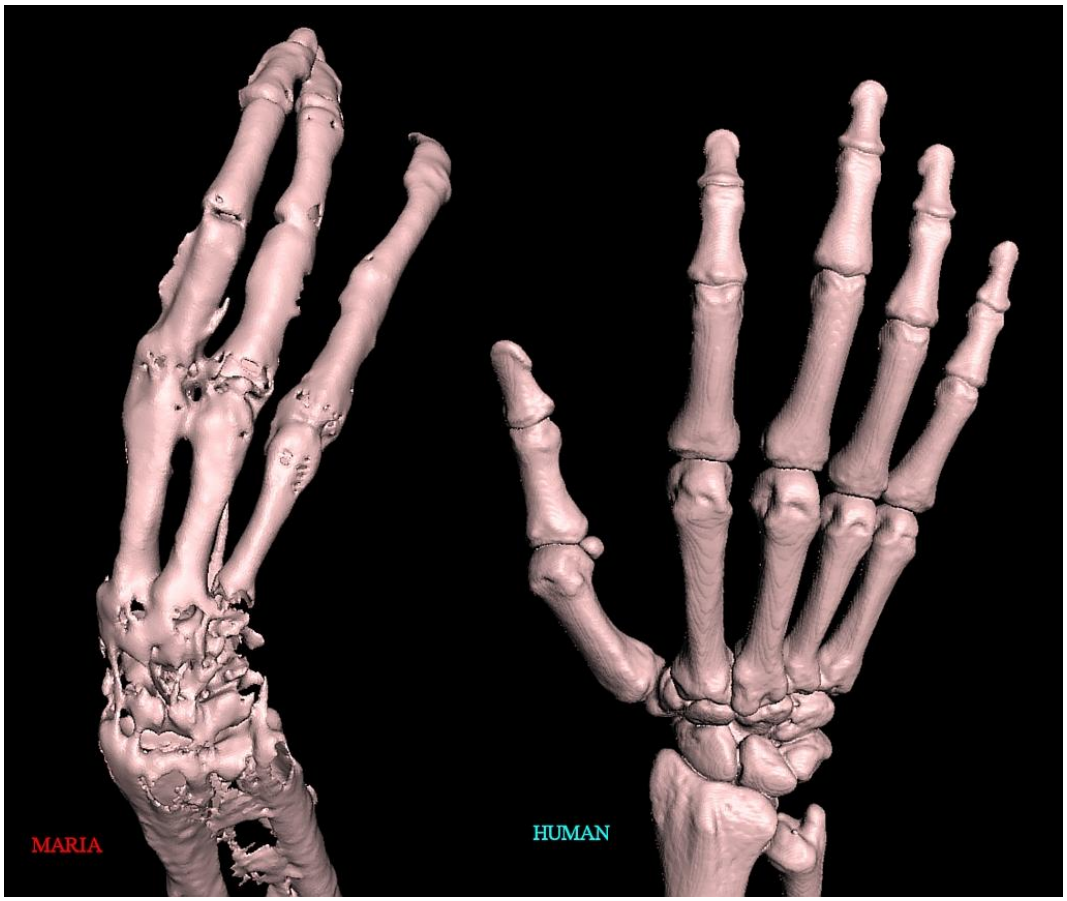

Figure 41: 3D CT right hand of ‘Maria’ comparing with a human hand. Note the gross difference in size, shape and proportion of the wrist and finger bones.

Figure 42: 3D CT of right and left hands of Maria. Note the natural curves of the fingers embracing the arms.

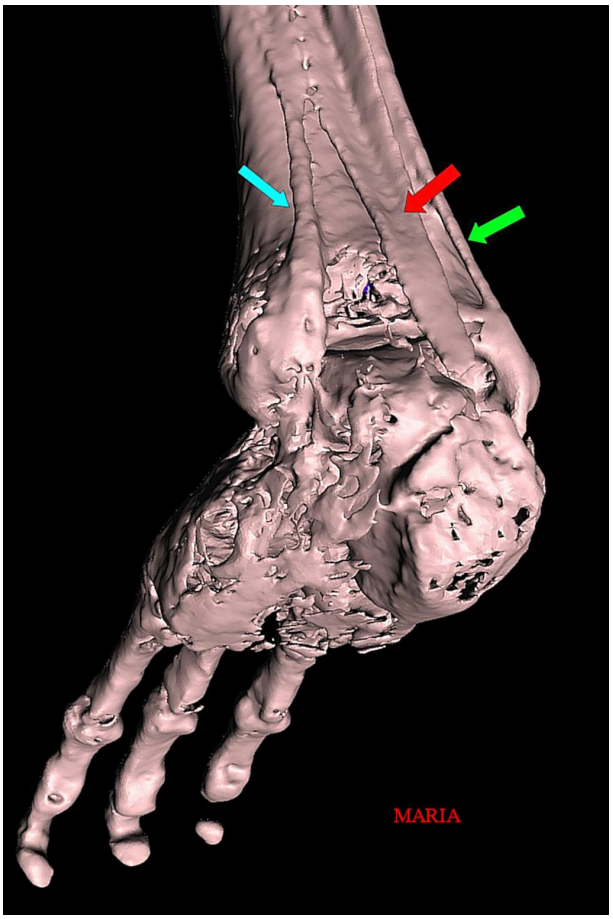

Figure 43: 3D CT of heel of ‘Maria’ showing the Achilles tendon (red arrow), peroneal tendons (green arrow) and posterior tibial tendon (blue arrow). Note the distal end of the Achilles tendon and posterior surface of calcaneum appeared to be truncated.

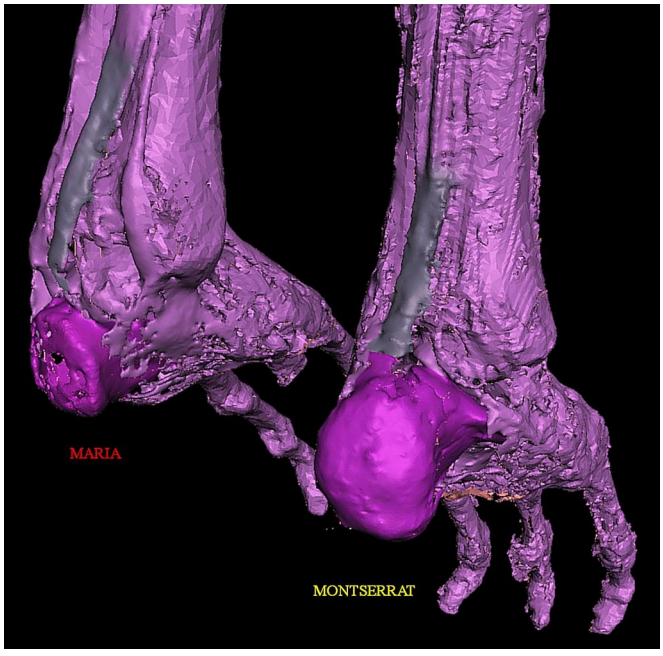

Figure 44: 3D CT of heel of ‘Maria’ comparing with ‘Montserrat’. Note evidence of truncation of the posterior surface of calcaneum and distal part of Achilles tendon in ‘Maria’. Those structures were intact in ‘Montserrat’.

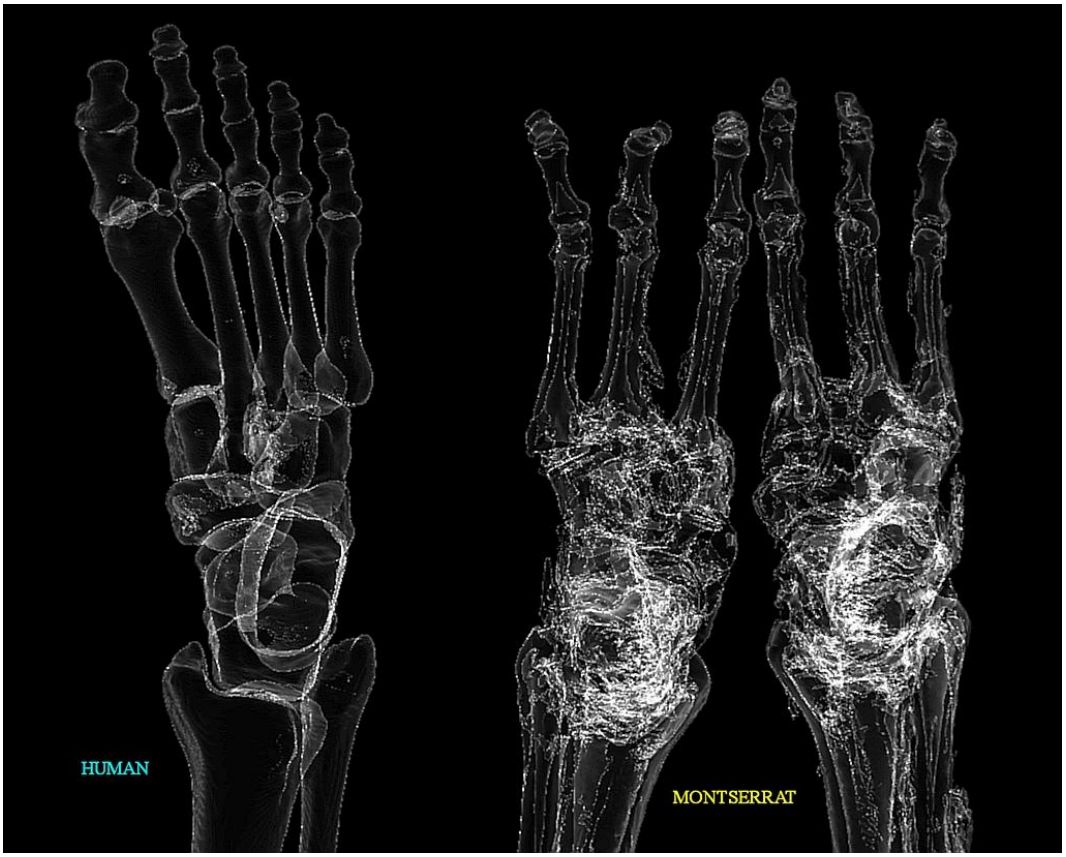

Figure 45: semi-transparent 3D CT comparing a human right foot bones with bones in both feet of ‘Montserrat’. Note the completely different bony architecture.

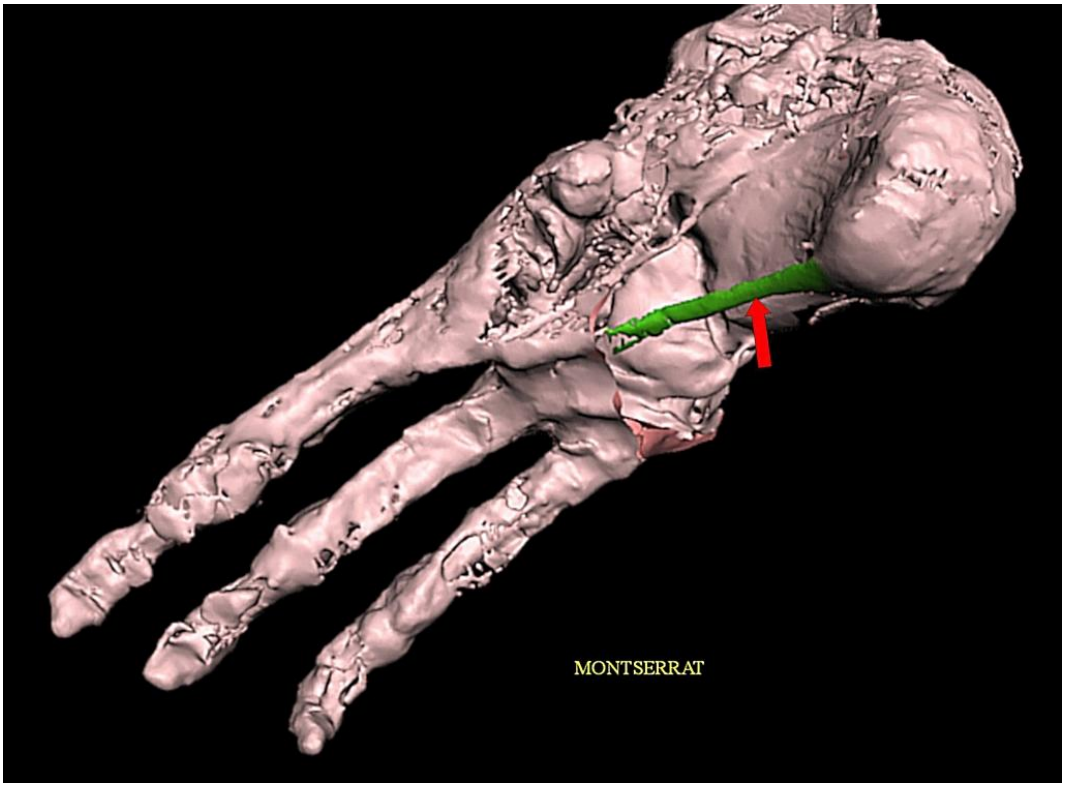

Figure 46: 3D CT showing cord-like plantar fascia (red arrow) in right foot of ‘Montserrat’.

Figure 47: 3D CT showing plantar arches between ‘Maria’, ‘Montserrat’ and human. Note the claw-like deformity in toes of the tridactyls.

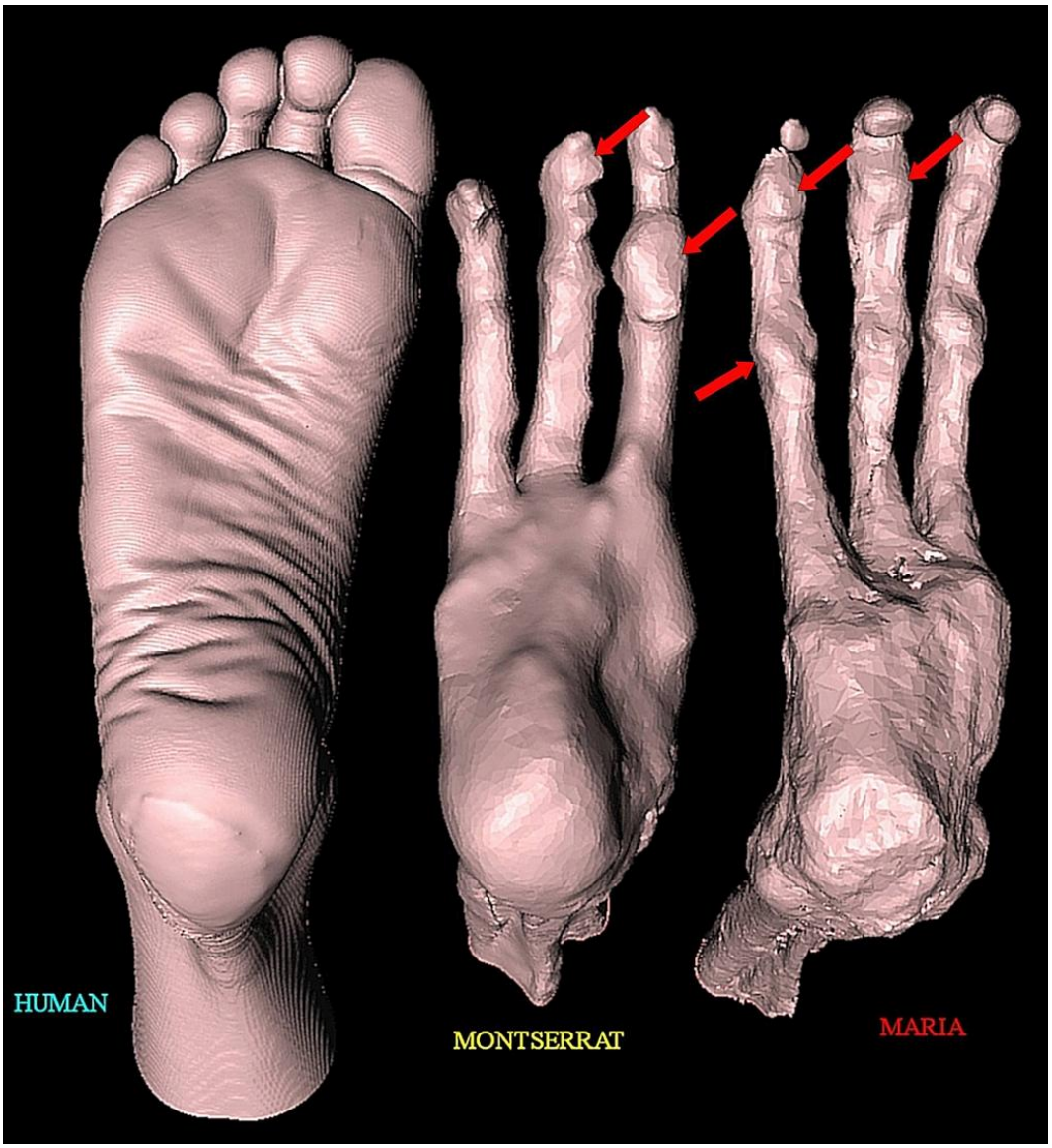

Figure 48: 3D CT comparing plantar aspects of foot in human, ‘Montserrat’ and ‘Maria’. Note the contact pads on the foot (red arrows) and the thick soft tissue beneath the tarsal bones with abrupt transition to the thin soft tissue in digits.

SECTION IV: CONCLUSION

- **VALUE OF CT:** CT is an extremely useful, cost-effective and non-invasive method for studying Tridactyl mummies and is particularly useful in investigation of archaeological finds. It provides invaluable information on the state of preservation, detailed information of the gross specimen, confirm missing body parts, highlights details of internal anatomy, identify presence or absence of any metal artefacts or any involvement by pathological processes. Furthermore with 3D reconstruction or advanced visualization technique e.g. stereoscopic presentation, imaging data can be closely correlated with real or pathological findings. Incidentally, CT is also a highly sensitive non-invasive imaging modality in identifying any manipulation or artefacts on the specimen by showing differences in CT value of artificial materials versus natural structures, comparing size and shape, identifying alignment, orientation, anatomical context, and even orientation of bony trabeculations.

- **WHAT ARE THE TRIDACTYLS:** The sophisticated and complex well orchestrated external and internal complete anatomical structures shown by CT are documentary evidences of real biological entities, dispelling any claim of hoaxes nor reassembled body parts. Various pathological processes and evidence of bone healing are evidences of a once living biological entity. The anatomical structures of the feet and condition of the spine, including degenerative changes due to posture, are firm evidence of a bipedal posture. The close resemblance to human in many body parts and the anomalies that had never been made known in human in normal, anatomical variants, genetic disease or syndrome suggest an **unknown bipedal hominid species that had once lived on earth**. In addition, authentic artefacts including intricate textile, pottery and petroglyphs featuring three finger beings suggested that tridactyls had been in contact with human civilization and had played a significant part in human history. Whether tridactyls hominids are genetic hybrids with human beings and showing variability in genetic expression remains to be verified.

ABOUT DR. FUNG

Dr. K H Fung is a retired radiologist with over 40 years of experience in diagnostic radiology. His special interests include 3D medical visualization, interventional radiology and neuro-intervention.

Dr. Fung is also an artist in the domain of intersection of art and science utilising his expertise in 3D medical visualization. Dr. Fung was the first place co-winner in the '2007 International Science & Engineering Visualization Challenge' organized by Science magazine and National Science Foundation (USA).

His artworks had been exhibited in museums in various countries including USA, Europe, China, Australia and Hong Kong.

He had current exhibits in 2025 in the Hong Kong Museum of Medical Sciences (featuring stereoscopic 3D and 4D medical imaging and art) and in Nina Park (featuring the Nina wood fossils collection) in Hong Kong.

Through his collaboration with Science Photo Library, his interdisciplinary artworks bridging art and science had been made available to various international renowned digital media, magazines, books, and journals.