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FINAL REPORT

PROJECT NAME: "Unknown Metals and Minerals in the Pre-Hispanic Mummies of the Ica Region"

PROJECT START DATE: 2022

DURATION: One year

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JULY, 2023



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1 SUMMARY

The tridactyl mummies of Nasca have caused uncertainty in the scientific world since 2016. Although it is unlikely that the bodies will be falsified, at least according to current scientific knowledge, the many metal implants remain confusing. Its final composition is unknown in detail. Only their analysis can prove without a doubt which metals were used in antiquity and how. In addition, rock deposits can provide information on the extent to which certain minerals and metals were likely used in the area. Possible chemical compounds beyond that should also be the subject of a thorough scientific analysis before pseudo-scientists or ufologists report on the subject and ridicule the issue.

In this research report, an attempt has been made to present evidence or indications regarding the nature of the three-fingered mummies (tridactyls) from Nasca, which could then be used to prove their veracity or, conversely, whether the objects are a new quality of mummy forgeries made with a technique unknown to date.

Figure 1.

X-ray of Josefina's mummy, abdominal part with eggs, right part of the pectoral implant

Taken from Alien Project (GAIA).



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2 INTRODUCTION

2.1 Tridactyl mummies

Two types or species of tridactyl mummies are known to date:

1) The small mummies of about 60 cm named "Albert", "Victoria" and

"Luisa" that are currently at the University of San Luis Gonzaga in Ica, and previously there was a mummy called "Josefina" of the same size that, after some studies carried out by institutions and organizations, was claimed by its discoverer. Its current location is not known.

The characteristics of these mummies are, among others: an elongated skull containing a desiccated brain, an auditory canal without a pinna, a single bone at a time in the forearm and the front leg, almost circular ribs, the atlas square instead of circular, hollow bones like birds, they share only about 30% of the DNA with homo sapiens. The anatomy coincides with that of a human being in the presence of the main parts of a human skeleton, but with great differences in its structure such as the number of vertebrae, the type of bone, it does not have two clavicles but only one furcula as in birds, the parts of the knee fit together almost like gears, and there is the presence of one or more implants in each of the mummies, etc. The implants in mummies considered female are the largest and most complex, as shown by X-rays and CT scans.



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Figure 2.

Left: details of the small tridactyls, right: details of the skull and vertebrae of the 60 cm tridactyls

Source: Dr. J. de la Cruz Ríos López (Mexico)



2) The other specimen is the 168 cm "Maria" mummy with human and other unknown features. It is considered a hybrid. Without going into details, only a few features of this mummy are mentioned, such as (according to Professor Galetskii, University of St. Petersburg): elongated skull; a single bone in the forearm and front leg; spine equal to that found in a human body, the only difference is in the absence of vertebra No. 7; there is no coccyx in it; In the lumbar part, there is an abnormality which is probably a melanoma; in the cut, there are two unidentified hard objects, they are neither metal nor bones; in the limb part there are wounds which present a shape as if they had been caused by the long claws of an animal such as a puma; there are faecal remains, the so-called coprolites in the digestive part; in the fingers there are no muscles that connect the phalanges and each finger has four phalanges; The heel has a different shape that would not have allowed the entire sole of the foot to be in contact with the surface of the earth, on the

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contrary, when walking, it rested only on the heel and toes. Otherwise, Maria's anatomy coincides with that of a human being. No implants were found.

Figure 3.

Mummy Maria CT

Source: Alien Project (GAIA)



Figure 4.

X-ray of the mummy Maria Source: Alien Project (GAIA)



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2.2 Objective, Purpose and Approach

The South American subcontinent and Peru in particular are strongly influenced by foreign research. In particular, traditional knowledge such as medicine and agriculture, but also various types of stories, is not usually written down and transmitted orally from one generation to the next. It is a second world of knowledge that follows its own rules and has many very different forms. These influences of orality and the still rare interpretation of historical traditions on ceramics and textiles make a problem such as the exploration of unknown bodies a particular challenge when it comes to investigating their origin.

One of the goals of the research project was to bridge the gap between the written and verbal historical knowledge and the presence of the petroglyphs from Palpa (Ica Department) and Toro Muerto (Arequipa Department) and the question of how the two information systems could best complement each other to trace the truth about the Nasca mummies.

It was very important that in addition to the unbiased research on the age of the mummies, their origin and their DNA, research was carried out that paid attention to the implants that can be found in each of the small mummies of about 60 cm.

The available information on implants in mummies is mainly presented in the INGEMMET report of February 2017. An important objective of this research was the analysis of samples taken from one of the implants of the Luisa mummy.

We were also interested in finding out if any cuts or traces of glue were visible on the mummies' skin.

Therefore, the goal of any investigation should be to separate the improbable from the probable according to our knowledge, placing emerging indicators for or against the authenticity of the mummies, in the historical and current context according to the analysis of implants, bodies of the mummies, some rocks and sediments of the area.



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2.3 Problem and initial situation

In the regions of Peru where there are a large number of artifacts and mummies, the number of huaqueros has exploded in a few decades. In particular, the excavations that surrounded the discovery of the Lord of Sipán have contributed significantly to this since the end of the last century.

It is therefore difficult for current research, especially when it comes to selling important historical finds to wealthy collectors abroad without being aware of it, to create as accurately as possible the overall picture of a complex culture and to arrive at a correct knowledge of the way of life of its bearers and their intercultural contacts.

The mummies of Nasca, which have been completely torn from a funerary context and some of which show serious damage, unfortunately add to this problem the effects of the huaqueo.

The acceptance of scientific results, taught by reputable institutes and universities (Abraxas, University of St. Petersburg, Lakehead University, Biotecmol, etc.) is hampered by the trajectory of donors, among which is mainly the GAIA organization, which focuses on ufology and paranormal issues. Some of the researchers commissioned by the organization had created the basis of distrust in themselves by previously declaring other extraterrestrial mummies.

Another problem is that, for example, the research of biologist Dr. Clara Martínez (Colombia) is ignored. During the press conference at the congress (Lima, Peru) in December 2018, she stated: "The loose head from which the INKARI institute took tissue for mitochondrial DNA studies is not reliable enough to be representative of the 60 cm dried tridactyl bodies that are the subject of this study, since it has not had a scientific study for prior verification of its real biological correspondence with a complete dried tridactyl body."

She continued: "The results of the mitochondrial DNA of this loose head and the large hand are only valid for these samples and are not comparable with the other results of the dried tridactyl bodies because they do not present a scientific study that allows these loose pieces to be associated with the complete bodies studied. From a scientific point of view, the results of the mitochondrial DNA obtained by the INCARI institute cannot be extrapolated to explain the DNA of the 60 cm dried tridactyl bodies that have been studied by the Gaia and Tercer Milenio teams. ... The analysis of the DNA ... of this loose head shows 100% belonging to Homo sapiens. This result cannot be used to call into question the results of the massive sequencing by BioTecmol and the Federal University of

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St. Petersburg carried out with the tissue extracted from the vertebrae of Victoria (dried tridactyl body without head) ... "

Figure 5. CT of the mummy "Wawita". Source: Alien Project (GAIA).



There are pieces with a size of about 30 cm that were undoubtedly assembled from animal parts. The research team led by French archaeologist Thierry Jamin and Mexican journalist Jaime Maussan reported the fact.

At the press conference in December 2018, Prof. Galetskii from the University of St. Petersburg explained the X-rays of the so-called Wawita mummy. They clearly showed that the child had five toes on each hand and five on each foot, and that from each of these limbs two fingers had been artificially removed post-mortem. The child likely suffered a violent death, as wounds were discovered in his abdomen caused by a sharp object such as a knife.



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By testing the handling of the child's cadaver by means of radiographic images and CT scans, comparisons can be made with images of tridactyl mummies, from which such violent interventions can be excluded.

Figure 6. Skull carved alone and large hand. Source: Inkarri – Cusco.



2.4 Risks

2.4.1 Coronavirus

At any stage of the research, there was a risk of contagion because the vaccines developed may not offer reliable protection. The problem has been solved with the use of masks in terminals, buses and in meetings.

2.4.2 Strikes and stoppages of play

Due to general discontent with rising living and energy costs, strikes broke out as early as the 2021 presidential election. Some longer-lasting strikes also hit the Ica region. At the end of 2022 and the first months of 2023, the Ica region was again affected, this time by strikes based on the arrest of the former president. These shutdowns directly affected our research, we were not able to travel to carry out the last works.



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2.4.3 Illness

Due to the stressful conditions of heat and dust and the ongoing threat of the coronavirus mentioned above, the project was also at risk of being compromised at any time.

2.4.4 Lack of material/equipment

Sampling and research in the outdoor domain required some materials and equipment, some of which were not available or very expensive.

3 STATUS OF THE INVESTIGATION

Since 2016, there have already been several research results on various objects related to the Nasca mummies. The mummies Maria, Josefina, Louise, Victoria and Albert, from which tissue and bone samples were taken and sent abroad for analysis, deserve to be particularly noteworthy. Of particular note are the universities and laboratories of Canada, Russia and the United States, which have provided most of the knowledge to date. However, the results of research in the field of DNA, C14, forensic medicine, implant analysis have not aroused serious interest from the scientific community or the general public. This contempt, the unsuccessful requests for help from the Ministry of Culture, the insufficient conservation of the mummies, and many other things, have prevented the development of in-depth research work to this day.

3.1 Theoretical foundations

The subject of this research work has links with archaeology and social history. Several theoretical references have emerged from the development of the subject and the research questions.

While many disciplines develop theories deductively and apply them to empirical reality, archaeology operates in an exploratory and theory-generating manner, i.e., it develops theories from empirical materials and proceeds inductively.

The theory of cultural relativism, which attempts to avoid classifying other cultures according to cultural imprint and worldview, offers some very interesting approaches in relation to this work. Cultural relativism recognizes the diversity of cultures and postulates that cultures



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cannot be evaluated or compared from the perspective of another culture. Cultural phenomena, such as those that might emerge from a closer analysis of the Nasca mummies and the likely site where they were found, can only be understood and evaluated from an ethnic perspective in their own context.

These theoretical foundations must be kept in mind at all times, even in the context of a purely technical investigation.

3.2 Related Research

Related research has been conducted on sub-fields of this topic at various institutions in Asia, Africa, Europe, and Australia.

There has been evidence of manipulation and falsification of mummies in Egypt since ancient times. A few decades ago, the sarcophagus of an alleged Persian princess was examined; at that time, using common methods such as C14 and handwriting analysis, a forgery could be proven without a doubt.

It has now become difficult for artifact forgers, particularly due to advances in DNA research and C14 analysis, to ensure that their fraud stands up to scientific analysis.

3.3 Preparatory work for the research project

The preliminary work of the research project is based on the evaluation of the press conference of the Peruvian Congress of December 2018, in which the deputy Villanueva at the time pleaded for the deepening of the research on the mummies of Nasca and therefore called for a press conference with international participation.

As experts, she has received specialists from Peru, Mexico, Colombia, France and Russia in the fields of forensics, general biology, DNA analysis and archaeology.

Additional results came from the funding of Inkarri, an NGO from Cusco, GAIA and Tercer Milenio, the latter two being organizations with little credibility at the international scientific level for their relations with the field of ufology.



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Most of the time, this involves analyzing genetic material and creating computed tomography (CT) images and X-rays of the mummies. Metal implants, which were not missing from any of the small mummies presented so far, were always mentioned and described as far as possible.

3.3.1 INGEMMET report, February 2017

In February 2017, the Inkarri Institute in Cusco published the results of elemental microanalyses performed by EDS (Energy Dispersion Spectroscopy) and INGEMMET on six samples sent by the INKARI-CUSCO Institute.

The first sample is composed of several fragments extracted from the pectoral implant of the mummy named Josefina, three of which are collected for analysis.



5 regions in the collected fragments and a total of 70 spectra were performed with elemental mass concentration measurements for each region. Also perform an EDS mapping of the elements carbon, oxygen, silicon, sulfur, chlorine, calcium, and copper for one of the three fragments. The set of mass concentration measurements performed in EDS for each area compiled in the following summary bar chart.

The sample consists mainly of metallic copper (averaging 85% by mass in the purest region) and some weathering has been observed to form oxidation products such as Cuprite or plagioclase or alteration minerals such as atacamite or Brocantite. This copper also contains impurities (iron, sulfur, etc.) that can be characteristic of the minerals from which the copper



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used to design the implants was extracted. These impurities may also indicate the extraction method used, in particular the presence of sulphur (probably from chalcocite-type sulphides).

Sulphur and chlorine concentrations in weathering products (e.g., atakam) may indicate weathering occurring in a chlorine and/or sulphur-rich atmosphere, such as in a coastal or volcanic environment. This sample also presents mineral chemical signals (carbonates, silicates, salts) which may be exogenous inputs (clusters around the implant) or the result of in situ crystallization under specific conditions.

There is also a mineral chemical signature (carbonates, silicates, salts) for this sample, which under certain conditions may be the result of exogenous input (gangue surrounding the implant) or in situ crystallizations.

In the context of the research, this sample corresponds to an object from the pre-Columbian era in terms of its chemical composition (copper, whose purity - which could be improved - is completely compatible with the refining methods known and available at the time). In addition, the oxidation and weathering products observed involve slow processes and therefore allow to confirm the age of the sample object, unless it has been exposed to a very aggressive environment (contamination). The mineral signature observed would also point in this direction in the case of in situ crystallization (slow process)

3.3.1.1 Lot n°1 - sample 03: annular metal implant of a tridactyl hand

A. Presentation

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Sample: Fragment extracted from a tridactyl hand annular implant donated by Dr. Paul Ronceros to the INKARRI-CUSCO Institute.

Figure 7.

Photographs of the three-toss hand where the source object of sample 03 of lot n°1 is implanted (circled in red).



B. Summary of Characterization Results in SEM/EDS

For this sample, 4 areas of the sampled fragment were analyzed, for a total of 27 spectra, each with a measurement of elemental mass concentrations. Elemental mapping was also carried out on part of the fragment.



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Figure 8.

SEM image (left) and EDS acquisition spectrum (right) of Batch 1 Sample 03. This spectrum shows a zone rich in iron Fe and chromium Cr, as well as the presence of manganese Mn.



Figure 9.

Elemental mapping with elements (C, O, Si, Cr, Fe) of an area of the fragment of sample 03 of lot n° 1. Chromium is localized punctually, in the form of small inclusions.





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To conclude, the following summary bar graph compiles all the mass concentration measurements made in EDS for each area:

Figure 10.

Summary table of measurements of the mass concentration of EDS in sample 03 / batch n° 1. We examined the concentrations of iron, chromium, as well as the elemental mineral signature and nickel, confined to a single zone.



This sample consists of an iron-carbon alloy (on average 78% iron to 5% carbon) rich in chromium (on average 16%), however, the EDS analysis does not allow us to decide whether it is steel (stainless) or cast iron (white). It is observed that this alloy does not contain nickel in its intrinsic composition, on the one hand, it does not contain nickel, on the other hand, it is detected locally in one of the areas analyzed at an almost pure concentration (average of 85%), which would indicate the existence of a nickel passivation layer for this sample (hypothesis to be considered, apart from a possible exogenous contribution, for example through pollution). So for this sample, it would probably have been deposited by electroplating (chemical or electrolytic bath) a steel or cast iron, possibly covered on the surface with a layer of nickel. A

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minerochemical signature is also observed in this sample, probably of exogenous origin (mineral gangue).

C. Discussion of the results as part of the study.

For the purposes of study (apart from considerations of elemental compositions: steel or cast iron, nickel electroplating, etc.), the main "problem" of this sample is that there are currently no pre-Columbian manufactured objects containing objects made of an iron-based alloy. The main reason is purely technical: the civilizations of the time did not master and/or did not know the techniques necessary for the extraction and processing of iron.

The only alternative to explain this fact in the hypothesis of an object created by a pre-Columbian civilization with this characteristic would be that the original object from which the parts were removed contained native iron of meteoritic origin (observed in other ancient civilizations), with an equivalent chemical composition.

3.3.1.2 Lot 1 - sample 04: metal implant of a tridactyl hand.

A. Presentation

Sample: composed of several fragments extracted from a disc-shaped implant from one of the tridactyl hands. Three fragments of this sample were taken for analysis.

Figure 11. Photographs of the metal implant from which sample 04 / lot 1 is extracted.



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B. Summary of Characterization Results in SEM/EDS

For this sample, 3 zones were studied on the collected fragments, for a total of 23 spectra performed, each with a measurement of elemental mass concentrations. Basic mapping was also carried out.

Figure 12.

SEM image (left) and EDS acquisition spectrum (right) of sample 04/lot 1. This spectrum shows a zone rich in silver Ag and Au gold, as well as in the presence of copper Cu.



Figure 13.

EDS Elemental mapping of a sample 04 Lot 1 Zone: elements O, Fe, Cu, Ag, Au.



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To conclude: the following summary bar graph compiles all the mass concentration measurements made in EDS for each area:

Figure 14.

Summary table of mass concentration measurements in the DHS of sample 04 of batch 1. Gold and silver concentrations are almost constant, as well as a mineral chemical signature.



This sample is mainly composed of a gold-silver alloy (and to a lesser extent copper), in an average ratio of about 60% gold to 30% silver (about 10% copper), with no hypothesis on the possible manufacturing technique of the original object (see below). We observe the presence of other elements such as iron in an inclusive way if we refer to the basic mapping, which could give an indication of the origin of the alloy with which the object from which the 04 sample was taken was made: it could be a native gold-silver alloy compatible with Peruvian mineralogy. It is also possible that a refining technique by impoverishment gilding was applied to the object, in which the results reveal a net enrichment of gold at the surface level, in parallel with the respective decrease in copper (fig. 27).

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There is also a mineralo-chemical signature (carbonates, silicates, salts) resulting from exogenous incorporation (mineral gangue enveloping the sample) or in situ crystallizations (slow processes in favor of certain conditions that would testify to the age of the source object).

C. Discussion of the results as part of the study.

This gold and silver alloy has a composition that is completely consistent with the alloys used in pre-Columbian times. The presence of impurities such as the inclusion of iron points in this direction, a plausible indicator of the use of native gold and silver alloy for the design of the object, in the absence of processes fully controlled by the pre-Columbian metallurgist for the production of this type of alloy. It would also be plausible that (in the piece examined) an alloy of the "gilding by reduction" type was used, including a gold-silver-copper alloy characteristic of many objects of the pre-Columbian period and much richer in copper in proportion by mass, the "tumbaga".

3.3.1.3 Lot 2 - sample 01: Albert's hip implant.

A. Presentation

Specimen: Fragment taken from the right hip implant of the Albert mummy, which has the geometry of a disc for referencing photographs, X-rays and CT scans.

Figure 15.

Photographs of the organism where the source object of Sample 01 of Lot 2 is implanted (circled in red).





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B. Summary of Characterization Results in SEM/EDS

For this sample, 3 areas of the sampled fragment were studied, for a total of 13 spectra performed, each with a measurement of elemental mass concentrations. The introduction also presents elemental mapping (chlorine, copper, silver)

Figure 16.

Elemental mapping of sample 01 of batch 2 (Cl, Cu, Ag). The distribution seems homogeneous at this scale.



Figure 17.

SEM image (left) and EDS acquisition spectrum (right) of sample 01/lot 2. This spectrum shows a zone rich in Ag silver, as well as the presence of copper Cu.



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To conclude, the following diagram averages and represents all the mass concentration measurements made in EDS for each zone:

Figure 18.

Summary diagram of the mass concentration measurements made in the EDS in sample 01/batch 2. This sample consists mainly of a copper-silver alloy with traces of gold.



This sample consists of a copper-silver alloy with a mass ratio of

Approximately 10% copper to 90% silver to 10% silver to 80% copper, depending on the area analyzed. These differences are due to several factors:

The main ones are the composition of the alloy used to manufacture the part (copper/silver ratio favoring certain microstructures), the manufacturing process used (casting, cold forging, finishing of the part, etc.), and the orientation of the sample during the analysis (also conditionally by its extraction from the original object). There is also a chemical-mineral signature (carbonates, silicates, salts) that could also be of organic origin due to the elements involved, especially phosphorus, which plays a role in bone composition.

C. Discussion of the results as part of the study.





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For the purposes of the study, the composition of this sample is very much in line with the standard compositions listed for pre-Columbian objects made of a copper-silver alloy. The microstructure observable in the topographic images suggests that the object was created by "cold" stamping copper-silver alloy sheets by beating, a technique also known for shaping many objects from the pre-Columbian period.

On the biocompatibility of an implant built with such an alloy, taking into account the chemical activity of copper and silver as a function of the context (pH, etc.), the histological consequences with regard to a living organism would be uncertain and would require the opinion of a specialist.

3.3.1.4 Lot 2 - sample 02: metal object in the shape of a cross.

A. Presentation

Sample: two fragments extracted from a metal object in the shape of a cross.

Figure 19.

Source object of sample 02 of lot 2. We noticed the presence of possible minerals at the bottom.





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B. Summary of Characterization Results in SEM/EDS

For this sample, 3 areas of the sampled fragment were studied, for a total of 13 spectra performed, each with a measurement of elemental mass concentrations. The introduction also presents elemental mapping (chlorine, copper, silver).

The following summary diagram averages and represents all mass concentration measurements made in EDS for each area in this sample

Figure 20.

Summary diagram of the mass concentration measurements carried out in the EDS in sample 02 of batch 2. This sample consists mainly of an alloy of gold and copper, or tumbaga, with traces of silver.



This sample has the chemical composition of an alloy of gold and copper (with some silver, on average 5 to 7% by mass), called *tumbaga*. The average gold-to-copper mass concentration ratio ranges from approximately 8% copper, 85% gold to 26% copper and 65% gold, depending on the areas analyzed. The analyses also revealed a mineral chemical signature (carbonates, silicates), possibly induced by exogenous contamination.

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C. Discussion of the results as part of the study.

For the purposes of the study, the gold-copper (-silver) alloy that constitutes this sample is characteristic of pre-Columbian manufactures, is called Tumbaga.

The Tumbaga technique (also Tumbago) is an alloy whose main components are gold and copper. The copper content can reach up to 70%. Tumbaga has a lower melting point and a hardness higher than gold.

Many objects of this alloy are listed. It is also interesting to note that the differences in concentration measurement are the result of a technique for refining tumbaga objects, gilded by "reduction", a technique regularly used by pre-Columbian metallurgists to embellish the objects designed. The hypothesis of the application of this technique on this object is confirmed by the porous texture of the surface in unaltered areas, a porous texture visible on the SEM image and created in topographic contrast. This example offers many clues that refer to an ancient origin.

D. Additional Comments

For all metal samples, it should be noted that none of them show trace amounts of arsenic (As) according to chemical microanalysis by EDS. Given the context of the study, this may be an important indicator of the origin of the objects (pre-Columbian period): arsenic, first used by the Mochicas, was sometimes added to alloys as a hardener, this is why it is found in several objects from the pre-Columbian period. It is also worth noting that this element may or may not be present in the minerals used to make the alloys used, which may indicate the place of origin of the minerals used to make the alloys (Petersen G. Georg, William E Brooks, *Mining and Metallurgy in Ancient Peru*) in relation to the culture that designed the objects, in addition to the extraction and manufacturing processes used.

The same can be said for the tin element Sn, of which no trace was detected during elemental microanalysis of the various metal samples. This metal, which is used to make bronze (coppertin alloy), has only been used significantly by pre-Columbian civilizations (about 1400 years ago) since the end of the Moche culture

/ beginning of the Inca culture, based on the analysis of available chemical compositions and their use in the manufacture of various artifacts of this period (Petersen G. Georg, William E. Brooks, Mining and Metallurgy in Ancient Peru). Tin in alloys prior to this period is only present in the form of an impurity (source of the minerals used). The absence of tin in the



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various metal samples examined may be a strong indicator of the period of production of the corresponding source objects in the context of the study (pre-Columbian civilizations)

3.4 Own preliminary work

An initial phase of field research in the Ica Desert and in the vicinity of the famous Nasca glyphs by Sabine Cremer was set against the backdrop of the research hypothesis concerning the probability of the presence of unknown creatures from history at the time of the Nazca culture and its ancestors and successors. For this first phase of field research, research questions were formulated and different methods were chosen for their research.

3.4.1 Documentary method and qualitative interpretation of images

There are several reasons to opt for the qualitative interpretation of the images using petroglyphs and the documentary method, which are directly related to the chosen research topic.

The documentary method dates back to Karl Mannheim and was developed by Ralf Bohnsack. In the documentary method, the image is understood as "a medium of 'idiosyncratic' meaning that must be distinguished from language." The image is understood as a document for a context of meaning. This idea can be traced mainly back to the art historian Ernst Panofsky, who applied it mainly to works of art. Panofsky is interested in the "true" meaning of the image, in the unwanted and unconscious self-revelation of a fundamental attitude towards the world that is equally characteristic of the individual creator, the individual epoch, the individual people, the individual cultural community (...). »

For Panofsky, the image is a historical document because it can be used to "reconstruct the worldview or habits of a specific era."

Other methodological approaches take up this idea. They do not only see the image historically as a document of an era, but they also see it in other contexts, such as the context of the phases of development (Wopfner...)". Because the meaning of an action is not an individual matter, but a social and often collective one. Basically, it's about the difference between what an image shows and how an image is designed.



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3.4.1.1 Investigations in the petroglyph fields

On one of the visits to Ica, he went to the Palpa petroglyph field, about 100 meters from the beginning of the road built by the Ministry of Culture.

Figure 21.

Photos: rock in the Palpa petroglyph field (left), rock with tridactyl image

(right)



Source: Sabine Cremer.

Several petroglyphs of tridactyl beings have been found at the archaeological site, one of them has been severely damaged, the possible factors for this are human intervention or climatic influences responsible for an erosion of the upper layer of the rock over time.

During a trip to the Arequipa region of the Majes Valley, similar images were found, albeit much smaller, in the petroglyph field of Toro Muerto.

According to Peruvian archaeological studies, the Palpa petroglyphs in the department of Ica were created by the predecessors of the Nazca culture, and some of the glyphs appear to be even older. There is no consensus among scientists on this subject.



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You can see especially the facts of daily life and the representation of the environment, which included everything between heaven and earth, such as people, domestic and wild animals, stars, sun, moon, rivers and mountains. Moreover, beings that look neither human nor animal were represented, on the contrary, only in parts.

Figure 22.

Petroglyphs of three-toed creatures at the archaeological site of Toro Muerto, Arequipa



Source: Sabine Cremer.

Figure 23.

Sabine Cremer with the petroglyph of a tridactyl in Toro Muerto (left), the same petroglyph with more contrast (right)



The situation is similar in the vast petroglyph field of Toro Muerto in the department

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from Arequipa, about three hours from the city of Arequipa.

3.4.1.2 Expert interviews

In mid-October 2021, to answer the first research question: What do the experts involved say about the discovery? Do the hypotheses already formulated make sense according to your criteria? An interview was conducted with experts in the field of anthropology and medicine.

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4 RESEARCH MATERIALS AND METHODS

4.1 Review I

4.1.1 Materials and samples

A combination of different methodological approaches seemed to us to be judicious when analysing the research questions posed: a combination of standardised quantitative surveys and qualitative interpretation procedures.

Przyborski and Wohlrab-Sahr write in their book: "(...) Knowledge of the different methodological approaches and their basic assumptions (...) can help to recognize in the field and on the basis of empirical material more than would be possible from a monoparadigmatic point of view.

- Microanalysis methods used in this research
 - Material used:
 - SEM: Scanning electron microscope
 - Stereographic microscope
 - Inverted metallographic microscope
 - Image Capture
 - X-ray diffractometer
 - Polishing tables
 - Abrasives for roughing and polishing
 - Light Microscopy

The mummy found has alloys stuck to different parts of its bone structure, so it is not possible to be assured at first glance that they are the same alloy. Scanning electron microscopy is a nondestructive method, it is very well related to the chemical characterization of an alloy, in order to determine its chemical and physical properties.



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The scanning electron microscope, or SEM (scanning electron microscope), uses a beam of electrons instead of a beam of light to form an image. It has a large depth of field, which allows a large part of the sample to be focused at the same time. It also produces high-resolution images, which means that features that are spatially close to the sample can be examined at high magnification.

The more electrons scanned in the device, the brighter the image will be on the screen, as the electron beam scans the sample, the entire image will be visible on the screen, a scanning electron microscope can magnify an image up to

200,000 times more, this is its greatest advantage over an optical microscope.

To ensure that the skin is free of cuts or other manipulations typical of counterfeit mummies, light microscopy was used. This method allows the digital microscope to be passed over the entire surface of a mummy. The collection of a sample does not apply in cases where the examination of an entire surface is required.

4.1.2 Examination of samples from the mummy Luisa

4.1.2.1 Preparation

The preparation was carried out according to technical standards:

- ASTM E3 "Metallographic Sample Preparation"
- Technical manuals of the ASTM E 407

"Micro Attack of Metals" standard used:

- ASM Metals Manual "Metallography and Microstructure"
- ASM Metal Manual "Atlas of Microstructures"
- ASM Metals Handbook "Fractography"



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No.	SAMPLE	SAMPLING	WEIGHT (in mg)
1	Skull bones	in situ	20
2	Abdominal tissue	in situ	20
3	Leg Fabric	in situ	20
4	Egg Material	Sample provided	10
5	Diatomite	in situ	5000
6	Metal Plate Shard	in situ	7

The following material was evaluated by multi-element spectral analysis:

Figure 24.

Extraction of material from an egg on the body of the mummy Luisa (source: ZDF - Terra X Channel: Harald Lesch: "ungelöste Fälle der Archäologie").



A sample of the Luisa mummy's implant was also analyzed.

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4.1.2.2 Treatment

In this analytical method, the sample is dried at 100°C, then pulverized and placed on spectroscopic graphite electrodes, and subjected to a flow of electrons that produce electron transitions characteristic of each element of the sample except the gaseous elements. Analytical determinations are made as a function of the wavelength and intensity of each element that makes up the sample, limited by the weights of each sample.

4.1.2.3 Results

The results have not been published and have only been revealed in detail to a small circle of people so far for the personal reasons of the specialists involved in the research. In this context, it refers to section 1.3 of this report, and only a summary of some of the analyses is presented.

According to the results of the analysis of the implant sample by scanning electron microscopy (SEM) and X-ray diffraction, where the presence of chemical elements such as copper (Cu) predominates, followed by tin (Sn), silver (Ag), osmium (. Bone), localized carbon zone of the sample, presence of transition element Osmium (Os), also a compact copper (Cu) based alloy material, there is no presence of arsenic and nickel.

Osmium is the densest material available and the hardest metal, "Brinell hardness" is applied, i.e. hardness is measured by the depth of penetration.

The fact that this metal is so dense means that the individual atoms are very dense and compact with each other. And it is precisely for this reason that they also have a high melting point: osmium melts at more than 3000 °C.

This high melting temperature was also one of the reasons why osmium was used as a conductive metal in the first ampoules, i.e. as filaments.

Osmium is considered the most valuable precious metal in the world. The scarcity of the metal, which drives up the price, is particularly interesting. One gram of osmium costs around 1,869.48 euros.

If the mummies of the Nasca Tridactyl are fakes, then the question arises as to why the forgers used the world's most expensive precious metal when they could have included any other metal.

As far as diatomite is concerned, the presence of Si predominates as a major element (greater than 10%), and the minor elements (between 10 and 1%) are aluminum (Al), iron (Fe),



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magnesium (Mg), sodium (Na) and potassium (K), while trace elements (between 1 and 0.0001%), calcium (Ca), titanium (Ti) and phosphorus (P) are observed.

Based on the results of the analysis of metal plate flakes where copper (Cu) predominates, a lower percentage of tin (Sn) and trace elements such as silver (Ag), magnesium (Mg) and sodium (Na) are observed.

4.1.2.4 Trouble

According to the report of the laboratory concerned, the analysis of the metals was carried out by X-ray diffraction. X-ray diffraction, also known as X-ray diffraction (XRD), is the diffraction of X-rays into ordered structures such as crystals or quasicrystals. In principle, X-rays exhibit the same diffraction phenomena as light and all other electromagnetic waves. X-ray diffraction is used in materials physics, crystallography, chemistry, and biochemistry to examine the structure of crystals, which is called X-ray diffractometry.

The XRD method is not considered the most useful method when it comes to metal analysis. But it would be used in the analysis of thin films or films, i.e. layers of solid materials in the micro or nanometer range. These thin films often exhibit physical behavior such as electrical resistance or conductivity, among others, that differs from that of solid bodies of the same material. In this way, it is also possible to obtain properties that would not otherwise be available. Thin films are used in surface finishing and microelectronics.





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4.1.3 Examining the skin of Albert and Maria's mummies

4.1.3.1 Preparation

The analysis of the skin of Albert's mummy was performed with the Gloptics U1600X digital microscope for the magnified view of an area up to 1600x.

The main objective of the investigation was to look for anomalies such as cuts, glue stains among others, to later initiate a detailed investigation of the mummy with regard to a fake, if any.

The first mummy analyzed was Albert's, which was placed on an examination table so that the front of the body was freely accessible.

When examining the mummy Maria, only a few parts of it could be scanned with the aforementioned microscope. Taking the mummy out of its display case involves too many risks, such as the fall of parts of the feet.

To protect the bodies of the mummies from contamination, appropriate precautionary measures were applied, such as the use of masks, surgical gloves and disposable aprons.

4.1.3.2 Treatment

During an examination using a portable digital microscope, freely accessible parts of the body are examined step by step through the instrument, and photographs are taken of different parts, preferably of the same surface structure, as well as abnormalities and the resulting images are analyzed in detail.



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Figure 25.

Reptile and details of its epidermal keratin scales Source: schubu.at, "46. Merkmale der Reptilian).

Figure 26.

Albert mummy skull, 1600x magnification, skin details with epidermal scales, partly covered with diatomite. Source: Sabine Cremer.



It was not possible to examine all areas of the body of the mummy Maria in detail due to the lack

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Further micrographs of this mummy, for example, are needed for the field of archaeology, in order to be able to assess the surface in relation to its nature and typical characteristics.

4.1.3.3 Results

In the subsequent analysis of the photographic material taken during the examination, a skin structure similar to that of reptiles, i.e. in the form of scales, could be seen.

It should be noted that the similarities are more related to lizards of the reptile family Lacertidae within the order Squamata.

Crocodiles, for example, which are considered reptiles in the broadest sense, are more closely related to birds than to other reptiles. Although 2500-year-old Egyptian mummified crocodiles have been found, a comparison of these mummies with those from Nasca would be futile due to how little they have in common.

Figure 27.

Mummy Albert, left. mouth (objects or tissues are visible in the oral cavity); On the right finger of the right hand without fingerprints, a reddish-orange color is noted in parts of the finger phalanx



Source: Sabine Cremer.

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Figura 28.

Mummy Maria, fingertip of right hand with nail, two different angles, spots and yellow areas are noticeable in this part of the finger



Source: Sabine Cremer.

Figure 29.

Left Eye of the Mummy Albert



Source: Sabine Cremer.

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Figure 30.

Mummy Maria, tip of left toe, reddish-brown spots are seen on parts of the skin and nail



Source: Sabine Cremer.

As can be seen in the photos above, Albert and Maria have dark grey skin with epidermal scales. In order to be able to tell with a high probability whether the mummies' skin does not contain even the slightest cut or drop of glue (without taking into account the cadmium at this stage), further micrographs are necessary, which must be taken after the mummies have been completely cleaned of diatomaceous earth.

The orange to reddish-brown spots or areas seen on parts of the skin of tridactyl mummies are likely the result of cadmium that has been found above the skin and under the diatomaceous earth.

Cadmium pigments are among the most durable pigments known, little affected by light exposure, extreme weather conditions, or use in high-temperature environments. Cadmium sulfide (CdS), which is golden yellow in colour, is the basic pigment of cadmium. By substituting zinc for cadmium in CdS, a range of yellow - deep gold [1.9% zinc sulfide (ZnS)], gold and lemon yellow to primrose-yellow (20% ZnS) is obtained.

The substitution of mercury by cadmium produces a range of orange-reds:



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from dark orange [11% mercury sulfide (HgS)] to light red, medium red, and dark red to garnet (26.5% HgS). Mercury-containing pigments are cheaper, but are less stable at high temperatures and in bad weather. The substitution of selenium by sulphur in CdS also produces a variety of orange-red: light orange [15% cadmium selenide (CdSe)] to light red, medium red and dark red to garnet (65% CdSe).

A complete cadmium test is recommended to know for sure the exact composition of cadmium in the skin of tridactyl mummies.

In 1817, Friedrich Stromeyer and Carl Samuel Hermann independently discovered cadmium in contaminated zinc carbonate. Stromeyer noticed that impure zinc carbonate discolored when heated, a behavior that pure zinc carbonate did not display. For almost 100 years, the metal was only mined in Germany.

Figure 31.

From left to right: Vice-Rector M. Alarcón, Sabine Cremer, Dr. Hernández with the tritodactyl mummy Albert.



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Cadmium is obtained as a by-product of the smelting of zinc and lead-zinc ores. Most cadmium is extracted by hydrometallurgical zinc plants, usually called zinc electrolysis plants. Smaller quantities are obtained by zinc pyrometallurgical plants and by lead smelters that process lead-zinc ores. The processing of zinc is based on the reduction of metal from oxides. Zinc concentrates, which are sulphides and typically contain 0.5 to 1.5% cadmium, are first roasted to convert the minerals into oxides and small amounts of sulfates.

The above leads to the question of how the cadmium that covers the mummies was obtained in ancient times, about 600 to 1700 years ago. Throughout history, some human knowledge has been lost, as shown by the cases of the Baghdad battery and Roman cement. On the other hand, no other mummies have been found on Peruvian soil with traces of cadmium to date, at least there are no reports of it.

4.2 Review II

In June 2023, a new sample extraction was carried out on one of the mummies (mummy named Edgarda) and with a free hand in the presence and by part of the team of researchers from UNI and the University of Ica Luis Gonzaga. The samples extracted were 3 in number, a sample of metal extracted from the chest of the Edgarda mummy and a sample of mineral powder extracted from its coating, in addition to a sample of the free hand of the tridactyl. The three samples were subjected to chemical analysis by XRD and X-ray fluorescence, in order to know their chemical composition and to extract a type of information that had not initially been taken into account. A literature search was also carried out on the possible provenances of the samples analysed from a geological point of view.



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Figure 32.

Edgarda mummy with metal implants, prior to sample extraction



Figure 33. Mummy Edgarda. Sample extraction.



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Figure 34. Hand only with implant



Figure 35. Hand-only implantation after sample extraction



4.2.1 Samples and materials

Figure 36. Table, description of samples and chemical analysis performed.

Muestra	Tipo de muestra	Análisis
Edgarga Chest	Metal	X-ray fluorescence
Edgarda Main	Metal	with dispersive energy.
Edgarda Coating	Mineral powder	X-ray diffraction

Chemical composition analyses were carried out using two techniques on the three samples taken (Table 1) by the LABICER laboratory (of the Faculty of Sciences of the National University).

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for which the Shimadzu EDX 800 HS X-ray fluorescence spectrophotometer equipment (see Figure 1) and the analytical X-ray diffractometer (see Figure 2) were used.

a. X-ray fluorescence chemical composition analysis of metal samples

This analysis provides qualitative and semi-quantitative information on the chemical composition of a solid sample, its analysis principle is to measure the energy drop of atoms when excited by an X-ray beam. The main advantage of this analysis is that it is a multi-elemental analysis and quickly in a sample without prior treatment, the technique indicated for this purpose since the extracted metal samples did not have a very large surface area. This analysis has the disadvantage of only analyzing metals that are in the sodium-to-uranium range in the periodic table, so light metals cannot be detected with this technique.



Figure 37. Dispersive energy X-ray fluorescence equipment.

Figure 38.	Results of X-ray fluorescence chemical composition a	nalysis in the r	netal sample
	of Edgarda's chest.		

Element	Results	Method of analysis
Silver, Ag	89.88	
Calcium, Ca	3.61	
Copper, Cu	3.06	
Silicon, Yes	1.00	X-ray fluorescence
Sulphur, S	0.78	
Iron, Faith	0.45	
Lead, Pb	0.20	
Phosphorus, P	0.16	



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Figure 39.	Table of the results	of the analysis of th	ne chemical composition	h by X-ray fluorescence
	on the n	netal sample of the	tridactyl hand alone.	

Element	Results	Method of analysis	
Silver, Ag	62.74		
Copper, Cu	34.33		
However, in	1.31		
the Phosphorus, P	U. <i>J I</i>	X-ray fluorescence	
Sulphur, S	0.44		
Silicon, Yes	0.31		
Tungsten, W	0.26		
Rubidium, Rb	0.04		

Both samples have a silver-based matrix and vary greatly in copper content, the sample extracted from the free hands has a copper concentration of more than 30% compared to the sample extracted from the mummy's chest. Sterling silver is the alloy with the closest chemical composition to the metal sample extracted from the breast of the Edgarda mummy (92.5% Ag and 7.0% Cu). In a Cu-Ag alloy, a copper content of up to 25-30% by weight is known to increase hardness and strength and moderately reduce ductility and electrical conductivity. Above this percentage by weight, copper decreases the oxidation resistance of silver and intensifies tarnishing by hydrogen sulfide or sulfur dioxide.

b. Analysis of the chemical composition of the powder sample by X-ray diffraction

It is the only analysis that can provide information about the chemical composition in the form of crystalline phases by means of the diffractogram analysis of a sample. To perform the quantification of the crystalline phases of the sample, the High score software was used according to the Rietveld Refinement Principle using the PDF-4 + 2023 library (currently the most comprehensive crystallographic database on the market). This analysis allows us to know the mineralogical composition of a sample, but only crystalline phases, the amorphous material of the sample cannot be quantified.





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Figure 40. X-ray diffractometer.

Figure 41.

Results of the analysis of the chemical composition of the mineral dust sample.

Compuesto	Formula	Resultados	Método de análisis
Silicon oxide (quartz)	Yes2	17.18	
Sodium chloride (halite)	NaCl	6.51	
Aluminum, calcium and sodium silicate (anortite)	Na0.482Ca0.518A11.518Si2.482O8	3 32.14	X-ray diffraction
Aluminum, hydrogen and potassium silicate	H2KAl3(SiO ₄) ₃	43.82	
(muscovite) Iron oxide (magnetite)	Fe3O4	0.35	



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Figure 42. Phase diagram of the copper-silver alloy.

The mineral sample has a high content of silicates and the presence of sodium chloride which is to be expected due to the origin of the sample, its diffractometer the most remarkable is the presence of amorphous material that can be evidenced in the thick bands and the high background of the spectrum this amorphous material can have several origins, from organic silicates to amorphous silicates.



Figure 43. Diffractogram of the mineral dust sample.

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4.2.2 Geological approach

4.2.2.1 The tridactyl mummies of Nazca and their relationship to different geological environments

Compared to the results presented by INGEMMET in previous studies, the presence of sandstone limestone rocks has been determined. Sandstone, a sedimentary rock with the same chemical composition as sand, so the rock is mostly composed of quartz, could also be found in small amounts of feldspar and other minerals. The cementitious material that binds the sandstone grains together is usually composed of silica, calcium carbonate or iron oxide. Its color is determined by the cementing material; for example, calcium carbonate produces white sandstones, similar to those found in mummies, which have contents of Ca, C, O, which corresponds to the mineral calcite (CaCO3), because the grains analyzed are arranged on a calcite matrix. Tarbuck and Lutgens (2005).

It is possible to correlate a geological formation with its respective repository environment based on its location and the presence of diatomites, which would allow us to explain the presence of chemical elements in the "Nazca mummies".



Figure 44. Previous petrographic studies conducted by INGEMMET (2017).



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Figure 45. Left. Sample of calcareous sandstone, with characteristics similar to those presented at INGEMMET. Right. Microscopic image of diatoms (photo: David Siodlak)

Diatomite or diatomaceous earth is a silica, formed by microfossils of diatoms, which are singlecelled aquatic algae that secrete a siliceous skeleton and belong to a diverse and very large group of algae that are found floating in marine and lake waters. Diatomite is a sedimentary rock that occurs in light colors, it is friable because it is composed mainly of skeletal remains of diatoms, so its percentage of silica is high, in addition, it is a very porous rock, of specific gravity or low density and with a very fine particle size.

This type of rock can be correlated with the Pisco Formation, which has this type of composition, a white lithological sequence, consisting of diatomites, with intercalations of tuffaceous sandstones and schists, present from the Pisco River to Camaná.

The levels studied are mainly composed of white and slightly yellow diatomite with laminations interspersed with fine detrital levels. The Pisco Formation (Median-Pliocene Miocene) corresponds to the last major sedimentation sequence, its coastal marine depositional environment. The layers of this formation have been interpreted as the result of a fairly widespread marine transgression (Muizon and Bellon, 1980; Sebrier, 1982).



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Figure 46. Geological section of the Pisco Formation composed mainly of sandstone.

Outcrops of diatomites are recorded in the upper part of the Pisco Formation of the Palpa and Lomitas quadrilaterals (terrestrial hills, Pampa Las Salinas, Pan de Azúcar, Pampa de Coyungo, La Tiza, Las Brujas, etc.), possibly the locations of the mummies due to the abundant presence of diatomites.

4.2.3 Conclusions

One could deduce from this that the metal piece extracted from the chest of Edgard's mummy has better mechanical properties than the piece extracted from the hand alone and that the latter has less resistance to oxidation. Regarding the goldsmithing process, some researchers and chroniclers mention that in ancient Peru only native silver was worked and others refer to the fact that purification processes were carried out from querargyrite, but by studying metallurgy in the south of our country, it is known that silver and copper do not appear natively in quantity until the middle and end of the periods. This is probably because native silver was rarely found on the surface and was obtained by some sort of rough casting. Silver and copper must have been scarce until this smelting process was discovered by the inhabitants of the highlands. Most of the major silver mines of the Incas appear to have been located in central Bolivia, but most of the silver in the vicinity of Ica contains lead, and even if only one of the samples contains lead, the lead content may be indications that the silver came from the Ica region or from an inefficient cupellation process. The sulphur content of the two samples may give us the idea that the silver being analysed may have come from a sulphide ore. According to William C. Raíz, silver alloys with a copper content of more than 20% is made up of synthetic alloys or alloys not found naturally in ores, perhaps evidence that mixtures obtained from these metals have been intentionally alloyed or an unknown alloy whose properties have not yet been studied, although it is not possible to infer per se which





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In the phase diagram of silver and copper, this alloy has its eutectic point at

28.1% copper with which a low melting point alloy is obtained, the metal sample from the hand alone has a lower concentration than the eutectic that should form on the surface of the yellowish or coppery laminar metal because these metals are almost insoluble in the solid phase. The remaining content in the alloys is subject to discussion as it may be impurities of the original mineral or an origin not yet studied.

As for diatoms, the sequence reflects events in a silicaclastic plateau marine environment attributed to the Pisco Formation (Adams, 1906), corresponding to the basin of the same name on its eastern edge. At these levels, diatoms characteristic of the Early Miocene have been recognized.

Figure 47. Research team June 2023. From left to right: Irvin Zúñiga Almora, Sabine Cremer, Pedro Toribio Pando, Roger Zúniga Áviles with the three-toed mummy Edgarda and the hand alone.





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5 REFLECTION ON RESEARCH

5.1 Epistemological classification of the research work itself

As they deal with different approaches to the theory of science, the research work can be classified mainly in the relativistic-pluralistic method-epistemology. In the opinion of some leading scientists, approaches to knowledge are not subject to a fixed value. An examination of the history of science allows us to conclude that the acquisition and change of knowledge did not always occur according to scientific-theoretical principles in the past, but by circumventing these methods and thus succeeded in an anarchic manner, so to speak. One example is Galileo Galilei, who, as we understand it today, worked in a rather speculative way. Science is not defined by specific rules, but research must be independent and neutral. He was successful in breaking with certain methods at certain times so that progress and knowledge could arise. The acquisition of knowledge should not be limited by rigid guidelines that may leave intuition and creativity aside.

5.2 Research potential

What was new in our research project was the intellectual approach of considering the ancient discoveries and the results of the discovery of the Nazca mummies with the same justification. The underestimation of the results of the analyses already carried out and the sometimes insufficient written preservation of cultural memory in the archives prevent the holistic development of a strong cultural (self) consciousness to date. Reference to one's own cultural roots is crucial to developing a distinct cultural identity and thus cultural self-confidence.

This had implications for our research, the result of which was to arrive independently and neutrally at the appropriate formulations on the authenticity of the Nasca mummies. Implants have played an important role in this, and a precise analysis of them will allow us to know what techniques were used in their development, whether known or completely unknown, old or newer.



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5.3 Contribution to science

The research project will provide important baseline data on the themes of the unexplained, the unknown, and understanding in the initial research in an exploratory and empirical manner. Based on this data, approaches are developed to teach information and research skills.

Based on the data obtained and the experiences carried out, we would like to make the following contribution to the continuation of the project:

- Presentation of the data obtained to the scientific world/national and/or international institutions
- Dissemination of data to relevant scientific communities
- Promotion or generation of scientific and/or academic cooperation agreements with national or international institutions.
- Promotion or generation of academic exchanges or mobility with national or international institutions.
- Representation of the Institution as an academic/professional expert in national or international media

Figure 48. *X-ray of the skeleton of the Josefina mummy with pectoral implant* Source : *Alien Project – GAIA*.



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