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***Llamaqñawin* (The eyes of the Celestial Llama, α and β Centauri), myths and the annual cycle of water in the Pachacámac Inca sanctuary**

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Resumen

El santuario Inca del dios Pachacáma (organizador-animador del tiempo-espacio) inició su apogeo con Tupa Inca Yupanqui alrededor del 1465 d. C., convirtiéndose en el centro oracular-administrativo más importante de la costa, y segundo en todo el Tawantinsuyo, “el imperio inca de las cuatro regiones”. Ubicado en la desértica árida costa central del Perú actual, el asentamiento de edificios de adobe y piedra tiene cuatro templos, catorce estructuras con rampas, varios patios y veintidós edificios, que ocupan 500Ha. El trazado urbano presenta tres ejes principales que establecen las direcciones básicas para el orden de casi todas las estructuras en la zona central, la interior y más ocupada del Santuario.

Los estudios arqueo astronómicos en el Santuario, con registros de azimuts tomados in situ (1991-2009), así como los estudios utilizando *software* SIG (2014-2018) sobre fotografías aéreas, imágenes satelitales y contornos panorámicos, y datos obtenidos mediante el registro geo-fotogramétrico realizado vía dron en 2019, confirman alineaciones dirigidas principalmente a la salida y puesta de: solsticios, extremos mayores lunares y a la salida de α y β de Centauro. El trazado astronómico del santuario, como un enorme marcador calendárico, haría posible el preciso registro del curso anual del tiempo y también el valioso diagnóstico y pronóstico de las variaciones hidro-climáticas, esenciales para organizar medidas propiciatorias y preventivas en actividades ceremoniales y agrícolas.

Entre las principales orientaciones edificadas del santuario, el largo alineamiento señalado por el “Portal Norte” y la calle del ingreso principal es admirable. Esta larga alineación señalaba (circa 1500 d.C.) a la salida de α y β de Centauro. La calle del ingreso principal con recintos adyacentes habría sido un pasaje tránsito con funciones ceremoniales. Estas estrellas conocidas como *Llamaqñawin*, están señaladas también geográficamente (a 33 km de distancia) allí donde el promontorio del cerro Pucusana toca el Océano Pacífico. *Llamaqñawin* son los “ojos” de la constelación oscura de la “Llama celestial”, la Yacana. En documentos etnohistóricos de la Sierra central del Perú, la llama está explícitamente relacionada a la temporada de lluvias (Guamán Poma, 1615) y como custodia del flujo del agua (Francisco de Ávila 1608). Así, esta alineación del ingreso principal al santuario, dirigida hacia los “Ojos de la Llama”, es reveladora, resultando ser un llamado de atención sobre el elemento por el cual fluye toda la vida: el agua.

El trazado del Santuario registra y celebra ciclos de astros, de ritos, de mitos; ciclos del clima y ciclos del agua, sustento de la vida. Sí, el santuario es un centro administrativo ceremonial Inca, pero en el sentido holístico que el antiguo mundo andino le dio a la deidad Pachacáma: el organizador y animador del todo, el fundamento, la fuerza impulsora de las sinergias que sostienen la vida en la totalidad del tiempo-espacio.

Palabras clave: Pachacámac, Inca, arqueoastronomía, mitos andinos, agua.

Abstract

The Inca oracular sanctuary of the god Pachacama (organizer-energizer of time-space) began its heyday with Tupa Inca Yupanqui ca. 1465 AD, becoming the most important oracular-administrative centre of the coast, and second in importance in all the Tawantinsuyo, "the Inca empire of the four regions". Located on the rainless desert central coast of present-day Peru, the urban complex of adobe and stone buildings has four temples, fourteen structures with ramps, several courtyards and twenty-one edifices, occupying 1,250 acres. The urban layout presents three main alignments that establish its basic directions in almost all the structures in the central zone, the inner and most occupied area of the sanctuary.

Archeoastronomy studies in the sanctuary, with azimuth records taken in situ (1991-2009), as well as studies (2014-2018) using GIS software on aerial photographs, satellite images and panoramic contours, and 2019 drone survey of the sanctuary providing geophotogrammetric data, confirm alignments directed mainly to the rising and setting of solstices, the major lunar standstills and the rising of α and β Centauri, revealing a landscape rich in cultural significance. The sanctuary's astronomical layout, as a huge calendrical marker, would also allow an accurate annual record of the course of time and the important diagnosis and prognosis of hydro-climatic variations, both essential to organize propitiatory and preventive measures in ceremonial and agricultural activities.

Among the main building orientations of the sanctuary, the North Portal's alignment with the Main Entrance street is remarkable. This long alignment pointed (circa 1500 AD) to the rising of α and β Centauri, known in Quechua as *Llamaqñawin*. This Main Entrance street with adjacent enclosures would have been a ceremonial transitive passage. These stars are also marked geographically at the place where the promontory of Pucusana hill (33 km away) touches the Pacific Ocean. *Llamaqñawin* are the "eyes" of the dark constellation known as *Yacana*, the "Celestial Llama". In ethnohistorical documents of the central highlands of Peru the llama is related explicitly to the rainy season (Guamán Poma, 1615) and as custodian to the flow of water (Francisco de Avila, 1608). Thus, the alignment of the sanctuary's main entrance directed towards the "Eyes of the Llama" is revealing, turning out to be a wake-up call about the element through which all life flows: water.

The sanctuary's layout both records and celebrates the cycles of the celestial bodies, the rites, the myths, the weather cycles, and water cycles: sustenance of life. The sanctuary is indeed an Inca ceremonial administrative centre, but in the holistic, inclusive sense that the ancient Andean world attributed to the deity Pachacáma: the organizer and energizer of the whole, the foundation, the driving force of the synergies that sustains life in the totality of time-space.

Keywords: Pachacámac, Inca, archeoastronomy, Andean myths, water.

During the splendour and expansion of Tawantinsuyo (the Inca “Empire of the Four Regions”), Tupa Yupanqui (1441–1493 AD), son of the great Pachacútec, visited as emperor, circa 1465, the renowned oracular sanctuary devoted to the god Ychsma, the “Maker of the World”. Allying himself to the important oracular deity (Santillan 1563), Tupa Yupanqui recognized the deity as the Inca god *Pachacáma*, the “organiser and energiser of space-time”, renaming the deity and the sanctuary as Pachacámac. Tupa Yupanqui rebuilt ancient buildings and expanded the sanctuary with the magnificent Panchaocancha (Temple of the Sun), a large Aqllawasi (house of the chosen women), an extensive elongated square, a portal and street connecting the centre of the Sanctuary with the northern Qapaqñan (the great Inca trail), and several other important buildings.

Upon the arrival of the Spaniards in 1533, the revered oracular sanctuary was a very important destination of distant central Andean pilgrimages, after the Qoricancha temple in Cusco and equal to the sanctuary at the Island of the Sun in Lake Titicaca (Curatola 2017). It is located on a desert promontory, at the Lurín river delta, in the arid coast of the Central Andes. This narrow, barren and extensive coastline is irrigated solely by rivers sourced from highland rains. To the East, there are faraway steep mountains, from where celestial bodies rise and rivers come from; and to the West is the vast immensity of the sea, gatherer of all waters and where all celestial bodies set. This cyclic resurgence in space and time of the beginning and the end of the day, the seasons and the year, with the intervention of celestial bodies, mountains,

rivers, deserts and the sea, day and night, life and death, was expressed during the Inca era through calendars of cultural celebrations and agricultural labour, as well as in cosmological myths. Among them is the myth of the revered dark constellation of the Celestial Llama *Yacana* (Zuidema and Urton 1976), related to the flow of water, and visible in the coast by its eyes (*ñawi* in Quechua), which are α and β Centauri, known as *Llamaqñawin*, “the llama’s eyes”. In this study I will argue that these *Llamaqñawin* stars would have been key to the sanctuary’s layout by Tupa Yupanqui.

As previous Archaeoastronomy studies at the Sanctuary (Pinasco 2007, 2010, 2017, 2022) explain, the alignment of its architectural and urbanistic elements such as streets, buildings and plazas reveal a sophisticated understanding of astronomical and calendrical meanings. There are three types of astronomic markers at the Sanctuary: one type are distant landmarks in the geographic landscape, visible from singular places; a second type are walls or small enclosures as markers suitable for astronomical scrutiny, useful for adapting ceremonial or agricultural calendars; a third type are streets, buildings and plazas with visual axes towards directions of astronomical and/or geographic significance, used for the transit or gathering of congregations at important calendrical festivities. This present study attends to this third type of astronomical pointers. I will describe the visual axis marked by the North Portal and the main long entrance street to the sanctuary, and its cultural significance.

Geographic and astronomical panorama

The surrounding view from the Sun Temple remains is remarkable. To the North-West at the place where the La Chira headland meets the sea, the winter solstice sunset is viewed; and to the South-East, where the Pucusana hill promontory touches the sea, rises *Llamaqñawin* (Figure 1[A]). The North is

indicated by Lucumo hill, and in the sea, the mythical Cauillaca island marks the South.

Previous studies in the sanctuary

(Lat. S. $-12^{\circ}15'34''$, Long. W. $076^{\circ}54'05''$)

Our astronomical studies at the sanctuary were performed in three periods. In the first period (1991-2009), we surveyed three buildings and the sanctuary's key urban axes, finding viewing places towards the Solstices and Major Lunar Standstill. In the second period (2014-2019) the survey included all the visible built components in the sanctuary: 497 units longer than 6 meters (walls in streets, buildings and plazas), registering length, azimuth and location. This process comprised data retrieved on-site, and in aerial photographs taken in 1931 (resolution: 1200-dpi), as well as satellite images (Digital Globe, 2013), all these georeferenced and orthorectified (UTM 1984-18S. ArcMap 10.3- AutoCAD Map). The collected data was then visualised in a histogram using MYSTAT, to identify coincidences in stars, mountains and buildings (Figure 2). In this third period, the previous data was contrasted with the 2019 drone survey of the sanctuary carried out by the Museo de Sitio Pachacamac (MSPAC) who kindly shared the data with us. This Drone

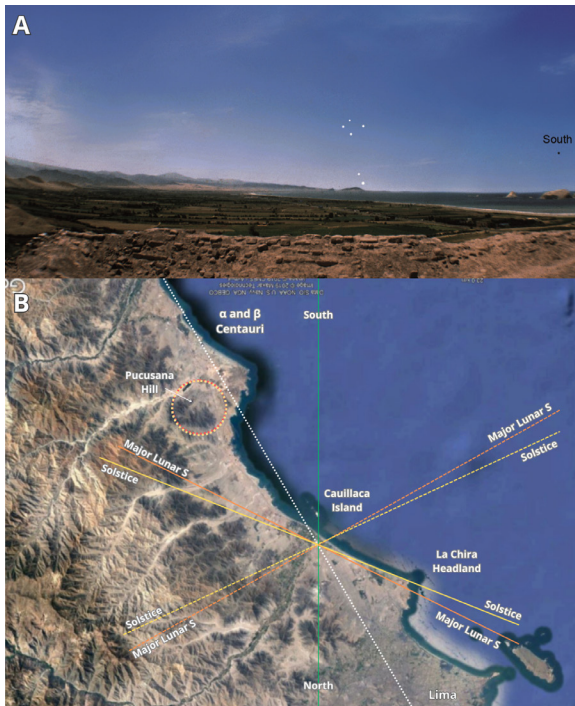


Figure 1. (A) South-East view from the top plaza of the Temple of the Sun. α and β Centauri are drawn over the Pucusana hill; to the right is seen Cauillaca island marking the South. Note the similarity between Pucusana hill and Cauillaca island. (Drawing of stars by the author. Photograph: courtesy Maria I. Renteria). (B) Geographic and astronomical panorama surrounding the Pachacamac sanctuary, viewed from the top plaza of the Sun Temple. The segmented lines show the architectural alignments and the continuous lines show geographical alignments. The long-dotted line shows the sole alignment marked by both architecture and geography. (Drawing and study by the author, upon a Google Earth satellite Image 2019 CNES).

geo-photogrammetric data allowed us to verify and refine our previous alignments and azimuth measurements.

The sanctuary's layout (see Figure 3) shows three main visual axes: The so called "East-West Street", oriented to the N-E and S-W solstices; the elongated plaza named "Pilgrim's Plaza", oriented to the S-W Major lunar standstills (Pinasco 2010, 2022); and the visual axis of the North Portal with the Main Entrance street, oriented towards α and β Centauri rise.

These three alignments establish the basic orientations for the order of nearly all the buildings in the central area, the inner and most occupied zone of the sanctuary.

The North Portal and the Llamaqñawin alignment

Coming from the nearby Lima valley, on the northern Qhapaqñan (the great Inca Road), visitors had to pass first through the *Tablada de Lurin* desert heights before arriving to the fresh valley of the Pachacamac sanctuary. Today this road crosses a very populated zone of Lima city.

In Inca times this arid road ascended a continuous and smooth slope, and reached, as it turned towards the south, a height of 120 meters above sea level. Suddenly the road offered a placid and beautiful panorama. The view reached the Andean foothills, the

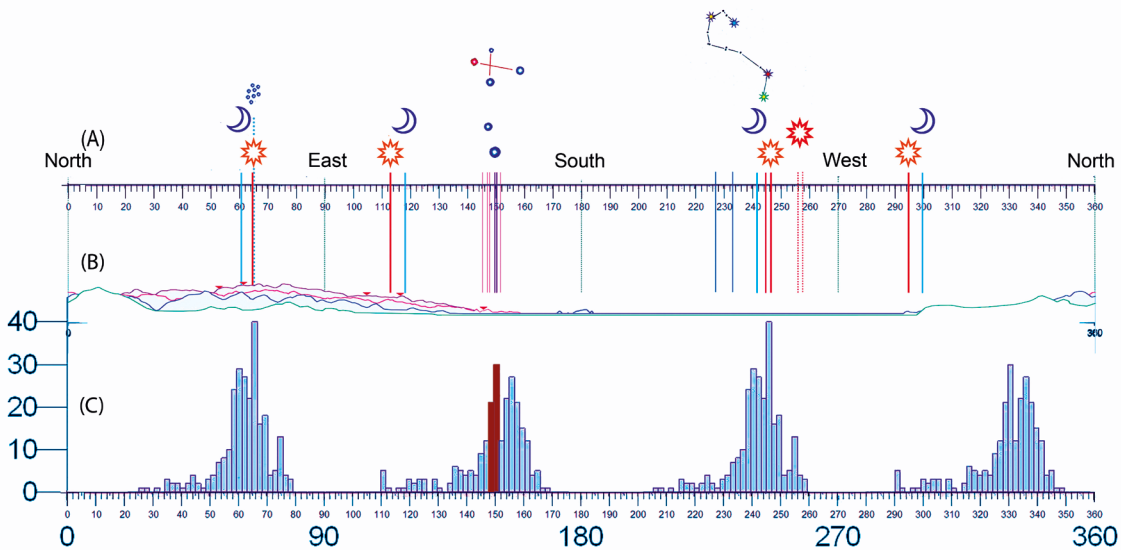


Figure 2. Chart contrasting the azimuths (1500 AD) of the (A) celestial bodies reported in the chronicles, with the visible (B) distant geographic horizon viewed from the top of the Sun temple, and (C) a histogram showing the frequency of the orientations (vertical blue bars) marked by the two azimuths in each of the 497 recorded walls $\geq 6m$. The red bars indicate the walls aligned towards Llamaqñawin. The numbers at the left (0-40) display the amount of all registered walls. (Research and composition by the author).

faraway desert coast with the Pucusana hill promontory 33 km away, the immense ocean with the white Cauillaca island, the nearby green valley, and below, at the centre of all this scenery, laid the brightly coloured ancient sacred sanctuary of the “creator of the world”. Descending the gentle slope, the visitors could have taken any path or direction towards it, but for the presence of a discontinuous transversal wall with an imposing gate (Figure 3), the North Portal. From an architectural standpoint, it is peculiar to find a single portal aligned to a distant street, at the

centre of the sanctuary, 1km away. But the ancient visitors aligning their path in its direction (1) would have found their view directed, with the far street below, towards the west slope of the Pucusana Hill, and if lucky (or wise enough) to arrive at the proper time, the visitor would gain an impressive rise of the “eyes of the Celestial Llama”, *Yacana Llamaqñawin*.

Standing at the Portal’s threshold (2), the height of the ruined “Old Temple” hides the distant Pucusana hill, but the street visual axis (3-4) continues to mark the *Llamaqñawin* rise. Descending on from the Portal, the visitor’s view would be submerged inside the Sanctuary. This ceremonial transitive passage almost 3km long and adjacent enclosures, always directed to α and β Centauri, would infuse the congregated residents and visitors, with meaning and significance related to the *Yacana*, guardian of the flow of water.

The view points in Table 1, are marked in Figure 3: Note that approaching the Old Temple the end of the street bends smoothly towards the East, this would be due because nearing the Old Temple, the visual horizon increases to an altitude of 6° , consequently, the azimuth of the stars rise decreases.

The astronomical and architectural analysis of this long central entrance, aligned towards α and β Centauri stars, seems to confirm a very strong ontological bond in the synergies among the Inca *Pachacáma* deity and the *Yacana*, guardian on the flow of water, and the rainy season in the central Andean highlands.

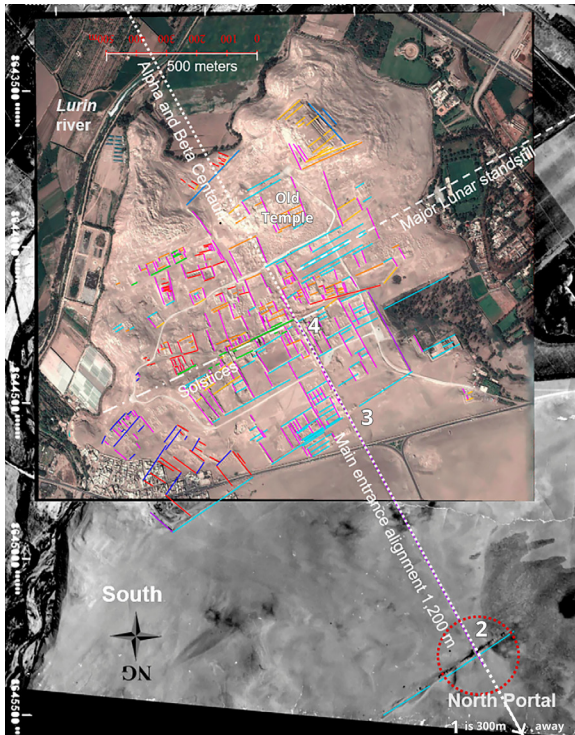


Figure 3. The three main alignments. Walls highlighted over satellite image (Google Earth, 31/5/ 2013) and aerial photograph (Shippee-Johnson 1931). (Author 2022)

PACHACAMAC SANCTUARY - S. 12.262° - W. 76.901° - LLAMAQÑAWIN MARKERS - 1500 AD								
Altitude and azimuth of the marker			Altitude of the horizon		α Centauri		β Centauri	
View point	Ground Lv.	Az.	Horizon	Alt°	Az.	Dec.	Az.	Dec.
1. Previous view	80masl	150.30°	Pucus. hill 380masl	3°	150.19°	-59.09°	148.97°	-57.95°
2. Portal view	50masl	150.52°	Old Temple 58masl	3.5°	150.01°	-59.08°	148.82°	-57.94°
3. Begins Street	26masl	150.05°	Old Temple 58masl	4°	149.84°	-59.07°	148.66°	-57.94°
4. Ends Street	28masl	148.64°	Old Temple 58masl	6°	149.25°	-59.05°	148.07°	-57.91°

Table 1. Alignments of the geo-photogrammetric data retrieved in situ, of the visual axes from the North Portal and of the beginning and of the end of the Main Entrance street, compared to the azimuths and declination of both stars of Llamaqñawin eyes. (Author)

Ethnohistoric- astronomical implications

In Guamán Poma's Ceremonial Calendar (1615) only two months display illustrations of a llama. The first llama appears in October, the beginning of the humid rainy season, and the second in March, at the end of the rainy season. The importance given to the cycles of celestial bodies, water and the renewal of life (Gose 1993) is also mentioned in the *Yacana* and *Cauillaca* myths recorded in the *Manuscrito de Huarochiri* (Francisco de Ávila 1608 [Taylor 2011]).

The black patch we call *Yacana*, the *cámac* or celestial prototype which gives vital force to the llamas [...] walks down the middle of a river (the Milky Way). [...] It has two eyes and a very long neck. [...] At midnight, without anyone noticing, this *Yacana* drinks all the water of the sea. If it didn't, the sea would immediately flood us all, and the entire world. (Taylor 2011, 121-122) [Author's translation]

Coinciding with Guamán Poma's calendar, α and β Centauri, rose -on 1500 AD- over the Pachacámac horizon on two important moments: before sunrise (heliacal rising) on mid-October, and at dusk (acronic rising) on mid-March, marking the extreme limits of the beginning and the end, respectively, of the usual humid rainy season in the central Andes. When it is time for the rains to cease in the highlands the *Yacana* could be seen during entire nights, traversing the sky towards the sea and plunging in it, drinking it down. At the Pachacámac sanctuary the rituals, oracles and ceremonies to propitiate the rain, or to beseech it to cease, would have been carried out especially during those dates and in the buildings pointing to *Llamaqñawin*.

Another myth mentioned in the Huarochiri Manuscript (Taylor 2011: 29-34) narrates the deeds of the powerful god Cuniraya Wiracocha, who used to disguise himself as a lice-infested pauper. He courts the affections of the beautiful goddess Cauillaca, who rejects him, appalled at his dreadful appearance. She flees, not stopping until she reaches the sea, becoming the island that is in front of the Pachacámac sanctuary. Gary

Urton (1982) points out that this myth could be a reference to the Pleiades chasing the dark constellation known as *Yutu* (“dove”). Following Urton’s inspired idea of celestial bodies chasing each other, forever unreachable in their trajectories, I interpret the myth in a different fashion. I propose Cuniraya as the Sun and Cauillaca as the Celestial Llama, the *Yacana*. Near the end of the story, Cuniraya takes off his rags and reveals himself, splendid and supreme luminous (the Sun); however, Cauillaca, unrelenting, flees away until she reaches the sea and plunges in it, becoming an island. The myth coincides with two astronomical 1500 AD events that mark the rainy season in the central Andes. The first is on *Llamaqñawin* heliacal rising on mid-October, when the Sun rises, and she disappears. The second is when on nightfall on the middle of March *Llamaqñawin* rises and, during entire nights, it traverses the sky towards the sea, where it sinks, to drink it up. This interpretation coincides also with the accidental similitude between the Pucusana hill promontory and the Cauillaca island, as seen from the sanctuary (see

Figure 1 A). They appear to reveal two moments of the same myth: the beautiful goddess arriving at the sea, and when she is already transmuted into an island.

Conclusion

The Inca layout of the sanctuary seems to mark annual astronomical events –mythical, cultural and climatic– upon which social life was upheld. It also marks the hydric periods that sustain it. The oracular counsel proffered at the Inca sanctuary ought also to have taken into consideration the record of time and cyclic weather; that is, the administration of the economic-agricultural calendar, as well as the necessary ritual relationships with the energetic entities (*huacas*), the ancestors (*mallquis*), the celestial bodies (*willcas*) and supreme deities.

Thus, it is revealing that the main alignment, crossing the centre of the sanctuary, is viewed, arriving from the northern Qapaqñan, marked with the North Portal, the Main Entrance street, and far away the Pucusana hill promontory aligned to the rise of α and β Centauri stars, the eyes of the *Yacana*. It calls attention to the element through which all life flows: water. *Llamaqñawin*, due to its relation to the myth of the *Yacana*, essence of all the llamas and custodian of the flow of water, therefore protector of life sustenance, this would remind to everyone equally of our humble and vital dependence on water. The sanctuary’s layout would exhort its visitors to reconcile personal and ethnic differences, in pursuit of a common welfare; and so, brimming with vital energy (*camay*), the sanctuary would have agency on water, the primordial

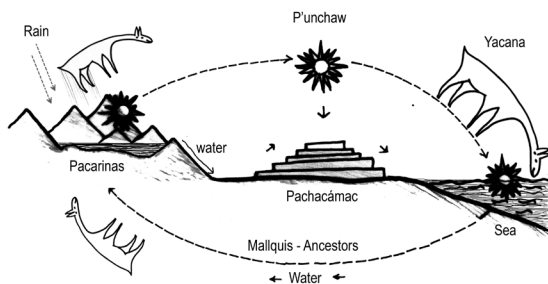


Figure 4. The cycle of celestial bodies, the flow of water and life above the sanctuary: the Lake Titicaca (the higher sea); the Sun (P’unchaw); the *Yacana*, the *mallquis* and *paqarinas* and the *Mama Cocha* (the lower sea). (Drawing by the author).

liquid, the fountainhead of the flowing life.

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Tools and software:

Drone Phantom 4 - DJIy Agisoft

TOPCON ES 105.

GPS Diferencial TOPCON Hiper Life

ArcMap 10.3

AutoCAD Map 2013

Google Earth: Image © 2017 DigitalGlobe

HeyWhatsThat: <http://www.heywhatsthat.com/>

Stellarium 0.20.2