

Global Journal of HUMAN-SOCIAL SCIENCE: B Geography, Geo-Sciences, Environmental Science & Disaster Management

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Received: 14 December 2016 Accepted: 2 January 2017 Published: 15 January 2017

Abstract

Stonehenge of Colombia, have been the subject of much speculation and fanciful interpretation for over four centuries. Not until recently, however, has systematic archaeological investigation identified El Infiernito as an astronomicalmeteorological observatory of the ancient Muisca culture. Modern surveys have begun to reconstruct the settlement history of the Leiva Valley, but little is known about the actual chiefdom community (ranked kinship society) for the stone observatory or how the it related to other communities in the region. Argued to have functioned as a calendar monument recording solar cycles, celestial alignments, and forecasting weather, many alternative interpretations are often uncritically accepted and fuel speculation for a local tourist industry as well as pseudoscientific fantasy. No serious study has attempted to ascertain if these monuments connect to anything tangible on the natural and cultural landscapes such as actual water features and specific celestial events. In an environment where effective rainfall is often insufficient or inconveniently timed for farming and alluvial farmland subject to intense erosion caused by periodic drought and flooding, the cosmological importance of fertility both agricultural and human tied to vital water sources and beneficial rainfall must have been of primary concern to Muisca leaders. A tangible response by a chiefly elite to such unpredictable conditions would include engineering a hydraulic landscape linked to intangible religious cosmology embodied in central stone monuments such as the monolithic observatory, temple structures, and artistic depictions of fertility. This report discusses the subsistence and ritual roles of water at El Infiernito based on recent climate change and human ecodynamic (socio-ecological dynamics of coupled human and natural systems) research. Recently, an engineered hydraulic landscape consisting of irrigation canals, check dams and drainage conduits, as well as potential raised

Index terms—

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This report discusses the subsistence and ritual roles of water at El Infiernito based on recent climate change and human ecodynamic (socio-ecological dynamics of coupled human and natural systems) research. Recently, an engineered hydraulic landscape consisting of irrigation canals, check dams and drainage conduits, as well as potential raised fields has been identified on the upland slopes and along the Rio Leyva alluvium near El Infiernito; pre-Hispanic canals and raised fields in this area were reported to be still in use in 16th century. In addition, a easy-west double row of stone columns (the observatory) diagonally aligned with the winter solstice and specific water fissures form the nascent waters of the Rio Leyva below the Cerro Santo looming behind the Colonial town of Villa de Leyva. Reconnaissance survey along these mountain arroyos revealed water pools, megalithic terrace tiers for a hilltop platform, and shaped monolithic stones adjacent to the confluence of mountain stream channels and the helioelliptical rising of the winter solstice. Importantly, associated with the terrace platform are unique and finely carved Muisca stone portrait statues showing mythical figures emphasizing themes of fertility recalling the Legend of Iguaque, a myth of cosmic ontogeny and ancestral origin. These preliminary data strongly suggest that water sources, solar cycles, and rites of fertility were linked to the astronomical-meteorological observatory at El Infiernito and an important new highland water temple.

1 I.

Background n the Leiva Valley, 120 km northeast of Bogotá, El Infiernito and its stone monuments including rows of aligned columns as well as dozens of phallus-like monoliths alleged symbols of fertility standing up to 4.5 m tall (Figures 1 and 2). The latter surround a dolomite slab tomb which is reported to have contained the remains of high status individuals (Silva 1983). Survey suggest that El Infiernito was the monumental center of a large town for a chiefdom by the 12th century AD if not earlier ??Langebaek 201; ??ajado 2011;Salge 2007). The astronomical and phallus cult interpretations of the various stone monuments remain perplexing because so little is known about the surrounding community.

The Leiva Valley is an altiplano region populated with Muisca chiefdoms along river floodplains and upland mountains between 2,000 m to 3,200 m (Langebaek 1995(Langebaek , 2001)). Climate classification is tierra frio except for desert páramo found above 3,500 m. A dual rainy season occurs from March to June and October to November with intervening dry seasons; evidence for past valley erosion is intense. Overall, the river floodplain adjoining El Infiernito averages less than 1,000 mm of rainfall per year, though evapotranspiration is nearly as high, but significant annual variation in precipitation throughout the valley is based upon geography, elevation, and major meteorological events such as the Southern Oscillation and its El Niño and La Niña Cycles (ENSO). The southernmost Leiva Valley is more arid extending into the Candelaria Desert. In addition, several major uplands rivers including the Rio Leyva flow near Muisca settlements, including the former chiefdom of Zaquencipá at El Infiernito (Falchetti 1975 ??998, ??000). Before the Spanish Conquest, the Muisca at Tunja and Bogotá were ruled by powerful paramount chiefs who were becoming politically and perhaps economically stratified absorbing many regional communities into more complex forms of sociopolitical organization (Broadbent 1964; ??ondoño 1985). Maize (aba) was the most important subsistence crop among the Muisca, though potatoes (yomsa) were also widely grown at higher elevations. Environmental conditions and an 8-month maturation rate for maize limited annual production to usually one crop and an average of about 2,000 kg per ha on the best farm lands, though irrigated agriculture on river alluvium was probably more productive. Production losses due to vermin and spoilage can be up to 30% even in a good year, and traditional maize varieties (pollo) used by the ancient Muisca had much smaller ears than today's hybrid varieties (Mangelsdorf 1974;Langebaek 1987;Smith 1988;Cardenas 2002). Drought, especially in the Leiva Valley, was and still is a constant problem and any rapid climate change effecting rainfall by reducing or swelling river levels (flooding) would have negatively impacted the production of maize as well as all crops. Such unpredictable climatic conditions arguably inspired water management strategies such as storage, irrigation, and raised field construction (artificially elevated planting surfaces).

Our contribution to site of El Infiernito is the newly discovered archaeological evidence for intensive agriculture and water management ??Smyth et al. in press). Reconnaissance identified hydraulic works and evidence for major erosion events potentially related to rapid climate change, i.e., significant droughts and/or major flooding episodes. The Loma Carrera (Figure ??a), an upland area, contains a natural perennial spring (Cañada las Peñas) situated above a carboniferous shale deposit that produces hydrostatic surface water that empties into the Rio Leyva. Near the spring are two possible anthropogenic ovoid pools reminiscent of the ceremonial baths or "lavapatas" at the Alta Magdalena site of San Agustín in southern Huila (Duque Gomez 1964; Drennan 1995). Seasonal drainage was captured by a catchment surface and stone conduit that connect to a double alignment of upright megalithic boulders above a cross-channel boulder wall (Figure ??b). These hydraulic features are seemingly part of a reservoir and check dam system designed to collect and divert runoff water for irrigation agriculture.

Trenching along the Rio Leyva floodplain revealed that the current topsoil has little soil development but a topsoil buried by 175 cm showed greater development (below) suggesting major past flooding erosion and flooding

events. Deeper cores indicated similar lower sequences, which showed evidence of more than one such cycle of erosion ?? Muisca cosmology embodied a religious philosophy of the natural environment centered around astral deities of earth and sky governing forces believed to directly influence human affairs (Ingativa 2012). A class of priests centered on the cult of the sun but ritual offerings and ceremonies concerned many deities including those related to water and fertility. Offerings and sometimes mummies were placed at caves, hilltops, woods, and lakes and temples were erected at sacred places populated with idols such as the large wooden Sun Temple of Suamox looted and burned by Spanish Conquerors in September of 1537 and reconstructed in 1992 (Figure ??). Temple sites were places of religious pilgrimage, offerings, and ritual performance especially on days of special importance such as the Winter Solstice, considered by the Muisca to be a sacred time marking the end of the solar year and the start of a new agricultural season which were closely associated with human fertility enshrined in the Legend of Iguaque.

The legend revolves around several alpine lakes (Iguaque) sacred to the Muisca and not far from the Leyva terrace platform (Figure ??). According to legend, mankind was born when the mother goddess Bachué (the one with naked breasts) emerged

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Chiefdom Ecodynamics and Muisca Cosmology in the Valley of Leiva, Highland Colombia from one of these lakes with the boy Iguaque in her arms. When the boy came of age, they married and their offspring populated the Earth. Finally, Bachué and Iguaque disappeared into the lake after being transformed into the bodies of snakes, where they are believed to still reside today.

3 II.

4 The Observatory

The stone monoliths at Infiernito (little Inferno) have been the subject of speculation since the earliest Spanish missionaries maligned them as works of the devil because of their alleged associations with controversial Muisca rituals and orgiastic ceremonies, and perhaps most significantly, the native refusal to adopt Spanish Catholicism (Simón 1625). Among the first archaeological expeditions detailing the various stone columns occurred in 1846 (Zerda 1972). Shortly thereafter, Juaquin Acosta wrote a new appraisal of the site dismissing prior claims of any 'lost civilization' responsible for erecting the monoliths (Acosta 1850), while others began to argue correctly that chibcha speaking (Muisca) native peoples were the actual builders (Ancizar 1984). As archaeology became a formal discipline in Colombia, studies began to focus on classification of the stones as well as associated artifacts and human remains ??Restrepo 1972; ??aenz 1922; ??riana 1922), though their excavations and analyses were not congruent with modern standards.

The most important recent study of the observatory was undertaken by Eliécer Silva Celis (1981) who excavated an area 38.5 m east-west by 16 m northsouth and 1.5 m deep called the Campo Sagrado del Norte (Figure ??). Within this context, he uncovered a row of 26 finely carved cylindrical pillars equally spaced following the meridian each with a height of 2 m and diameter of .35 m—20 additional columns were reconstructed. A parallel southern row of 54 columns was completely restored without any stones found in situ but repositioned based upon the remains of broken column's debitage in association, the finding historic metal tools used to remove stones, worked shell cached by the Muisca at the foot of each column, details of associated soils (color, texture, hardness, compaction, etc.), calculations of inter-columnar spaces, as well as the incorporation of information from written accounts of travelers and visitors since the mid 19th century (Silva 1986:49-52). Unfortunately, few statistical and few graphical presentations were published or reported documenting critical context and association information from the excavations. Centered between the aligned stone rows was an alleged 5 m tall upright column functioning as a firmament to measure the height of the sun and presumably other celestial movements. Four meters south is the Campo Sagrado de Sur composed of 2 rows of four ovoid columns (Moncada 1979) whose function remains unexplained.

Dating of the observatory was based on three published radiocarbon assays recovered from excavations (2,180+/-140, 2,490+/-195, 2,880 +/-95 BP uncorrected) controversially placing the site to the 2nd and 9th centuries before Christ. However, there are two problems with these dating results. First, there are no descriptions of the contexts of association for the carbon samples except for vague references to animal bones and maize remains (Silva 1981:13). Second, the Instituto de Asuntos Nucleares, the laboratory where these C-14 samples were analyzed, has a reputation for providing inaccurate results ??Langebeak 2001:28). Ceramic classification at Infiernito, conversely, dates the site to no earlier than 800 AD.

Two parallel rows of columns on the vernal equinox have a true azimuth of 91° and point east towards the Cerro Morro Negro (Morales 2009). The columns do not precisely align with the Laguna de Iguaque on the equinox as has been previously claimed (cf., Reichel-Dolmatoff 1982; Silva 1981). Importantly, a diagonal azimuth of approximately 113° measured from the westernmost column of the north row, passes through the alleged center column, continues to the easternmost column of the south row, and ultimately aligns within one degree of the true helio-elliptical rising of the winter solstice (Figures ??a-b) . This significant alignment cannot be coincidental because it also corresponds to mountain fissures and streams within the Cerro Santo behind Villa de Leyva where the nascent waters of the Rio Leyva flow by El Infiernito some 5 km to the west of the Terrace Platform

(Figures ??a-b). These alignments suggest that Infiernito was a solar observatory focused on water and human agricultural fertility, and not just a calendrical monument. The spatial connection between the water mountain and a terrace platform support the observation that the latter served as a water temple.

5 III. The Terrace Platform

A significant new Muisca site closely related to the Infiernito observatory emphasizes the vital interrelationships between water and fertility in the Leiva Valley. A terrace platform containing Prehispanic to Early Colonial Muisca surface ceramics, retaining wall stonework, large shaped megaliths, and the remains of megalithic tiers or staircase is located in the mountains behind Villa de Leyva. This possible Muisca temple aligns directly with El Infiernito on the winter solstice at one of the important times of the Muisca calendar year (socum)—marking the start of new agricultural cycle ??Restrepo 1895:162). The mountain fissures in this same area are major sources of water for the Rio Leyva which was integral to an irrigation system constructed by the Muisca.

The terrace platform is situated upon a high hill that appears to have been artificially leveled (below the peaks of the Cerro Santo) along the path of the solstice alignment midway between two mountain fissures (Figure ??). From this mountain, water flows into various stream channels leading into the Quebrada San Agustín, which flows around the hill and platform deep forming ravines on the west side that today requires a pedestrian suspension bridge. The hill platform is clearly terraced on the west side where huge megalithic stones aligned 238° show four extant tiers or stairs of dry-stone masonry. With many stones fallen or scavenged for recent construction, this architectural feature was probably originally longer and higher than what is seen today (Figure ??a). Encountered were diagnostic ceramics of the Late Muisca and Early Colonial periods, including a cached Fine Orange ring-based vessel (Figures ??b-c). There also appears to be more terracing on the east side along a possible access ramp or stairway leading down to water giving the entire structure a pyramidal shape, but only intensive survey and architectural excavation can determine this for sure.

The platform itself is supported by a 11-m stone retaining wall of cut stone masonry oriented 14° east of north with block cornerstones up to 100 cm tall (Figures 10-a-b). The west wall exhibits stonework that could have supported a possible palisade and a raised stone surface on-platform near the northeast corner suggests a circular superstructure (uta) likely some form of Muisca perishable walled and roofed building (temple?). The west wall extends more than 20-m before integration into a zone of shaped megalithics some over 2 m long but fallen from their original upright positions. Many stones form a boulder alignment apparently as a division or western platform boundary (Figures 11a-b). In this area a Herrera phase potsherd was recovered and along the platform west wall were ceramics of all Muisca time periods (Figures 11a-c). These ceramic data indicate ceremonial activity spanning the entire indigenous occupation sequence and suggest that religious rituals were performed here until the founding of Villa de Leyva.

6 IV.

7 Muisca Statues

Eight exquisite portrait statues from a private collection were examine in 2017 and are among the finest examples of pre-Hispanic stone carving known for the ancient Muisca (Figure 12a). Current evidence suggests that these statues were originally found at the same terrace-platform-temple or an associated context. Representing 12 individuals (6 males? and 6 females?), two adults (deities?) hug or hold from behind two seemingly adolescent children, while another adult holds two smaller children; all statues are three-dimensional portraits of seated-kneeling figures executed employing typical Muisca artistic conventions. In unsculpted form, interestingly, the stones resemble the shapes of the columns found at El Infiernito. Carved from local sandstone and limestone using stone tools, four statues are between 65 and 85 cm tall while the four smaller ones are about 25 to 35 cm. At least two of the larger statues exhibit a dark green patina or pigment, though it is difficult to rule out simple dirt or mold that has accumulated over the years. Three figures are damaged with impact scars resembling blows from a blunt instrument as well one statue which was repaired after a break at the waist and perhaps the top of the head. All statues show wear from being outdoors exposed to the elements for decades if not centuries suggesting great antiquity.

The statues are rendered in style and iconography typical for other Musica material culture: ceramics, goldwork, and textiles. All headgear are short conical caps, or gorros—some without decoration—others simply decorated with horizontal bands, pleaded-twisted rope, or simple triangles. One statue depicts long straight hair covering the ears hanging down at the back suggesting a female elite or deity figure. All others show shorter hair and stylized ears; one of the smaller male? statues is wearing earlobes and one female figure does a stone necklace. However, one crown-like headdress, a sign of high rank, displays four vertical zones of complex symbols and motifs including spirals, embedded triangles bordered by horizontal bands set above a round element (jeweled mountains?), and a spiral flanking three dots topped by reptilian-like dorsal scales (Figure 12b).

Facial characteristics reveal elements of status and ethnicity. First, the wide, slit (closed?) eyes are stylistically Muisca as are the broad noses, though there are three figures with longer, thinner noses. Round owl-like eyes on one smaller statue suggest a transcendental animal-like appearance. Most notable are the decorations representing face painting (1-3 lines) but are noticeably absent on two bare chested females and two child faces (Figures 12c-d). One of the largest sculptures depicts cross-line painting on the cheeks as well as seven painted? notches on

the bridge of the nose above a fanged mouth suggesting animallike dentition. A child in arms shows half-moon symbols under both eyes perhaps lunar associations, while all other figures depict closed mouths some with thick lips, though one child mouth is open suggesting speech or sound. On all figures, the arms are in a natural position with hands resting at the waist or below the head of children figures; the fingertips are touching and six digits are represented on each hand.

Finding stone statues at a terrace-platform is not without precedence in Highland Muisca archaeology. Silva (1968) reported eight Muisca statues similar in style and size at two terrace platforms exhibiting a pyramidal form at La Salina de Mongua near Sogamosa, an isolated highland riverine setting some 80 km east of Villa de Leyva. Three of these statues, on exhibit at the Suamox Archaeological Museum, show similar decorative symbols and motifs as those described above (Figure 13). The Mongua site has been interpreted as a sacred religious temple for ceremonies and rituals related to a water cult and human fertility.

The Leyva statues are far superior in workmanship to the Mongua statues, which should not come at any great surprise because the Muisca of the Leiva Valley were famed stoneworkers actually responsible for building many of the early Colonial buildings at Villa de Leyva. Like the Mongua temple, the Leyva terrace platform and statues must also relate to themes of water and fertility closely tied to worship of the sun as well as the origin myth of the Muisca. The alignment of the solar observatory at El Infiernito with a mountain water temple on the winter solstice surely emphasizes the great practical and cosmological significance of water for agricultural production. Human fertility is symbolized by female statues with large breasts (Bachué) while the portrayal of adults and children together clearly recalls the Legend of Iguaque.

V.

8 Discussion and Conclusions

The observatory at Infiernito has been the subject of much public attention over the years mostly in the form of amateur archaeoastronomy conjecture and even wild pseudoscientific speculation. Non-scholarly interpretations have largely prevailed because so little is known of the ancient community and its hinterland which were integral to understanding the role of the stone monuments. Indeed, it was not until the 1980s that the archaeological establishment even recognized any community associated with the observatory. In addition, archaeological research of Highland Muisca chiefdoms in the Leiva Valley has not focused on the role of the natural environment despite the fact that dual wet and dry seasons vary greatly, drought is not uncommon, and farming without irrigation is often marginal at best. To redress this deficiency, environmental research into chiefdom ecodynamics has begun to contribute new archaeological evidence for intensive agriculture and water management. It is argued further that hydraulic systems in the Leiva Valley were closely tied to religious activity of a mountain water temple and astronomicalmeteorological observatory at El Infiernito.

The preliminary data suggest that the El Infiernito observatory and water temple were important settlement features of the Muisca who observed a close cosmological relationship between the sun and water in both real and ritual terms. The precise diagonal alignment of stone columns connected to a waterrelated temple on the Winter Solstice undoubtedly marked a most significant time when the solar year ended and the agricultural cycle renewed. Born from a water mountain, this sacred water forming the Rio Leyva begins its journey towards the observatory, a symbol of fertility and solar power, that along the way was harnessed and controlled for agriculture via hydraulic means to ultimately sustain human fertility and the promise of continuing life.

Solar events and water mountains must have been times and places of cosmic ontogeny and ancestral origin. For the Muisca, the cosmology and environment of water were largely inseparable in that they saw no distinction or inconsistency between the physical and spiritual realms or actual or perceived aspects of their world. The uncertainties of drought, flood, famine, and hunger were all too real that required all manner of responses both tangible and intangible to survive the most significant challenges and unavoidable realities posed by their natural environment. In these regards, ecodynamic study explores the full-range of human adaptive abilities under conditions of environmental stress to determine how intermediatelevel chiefdom societies responded to adverse climaterelated conditions, a question largely unexplored in the archaeology of the Eastern Andean highlands. New understanding of the Muisca will add critical data about chiefdoms and diverse forms of subsistence agriculture no longer practiced in Highland Colombia. In this regard, multipartite ecodynamic approaches can represent an important new area of inquiry for archaeology and many of its allied disciplines.

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⁴Year 2017

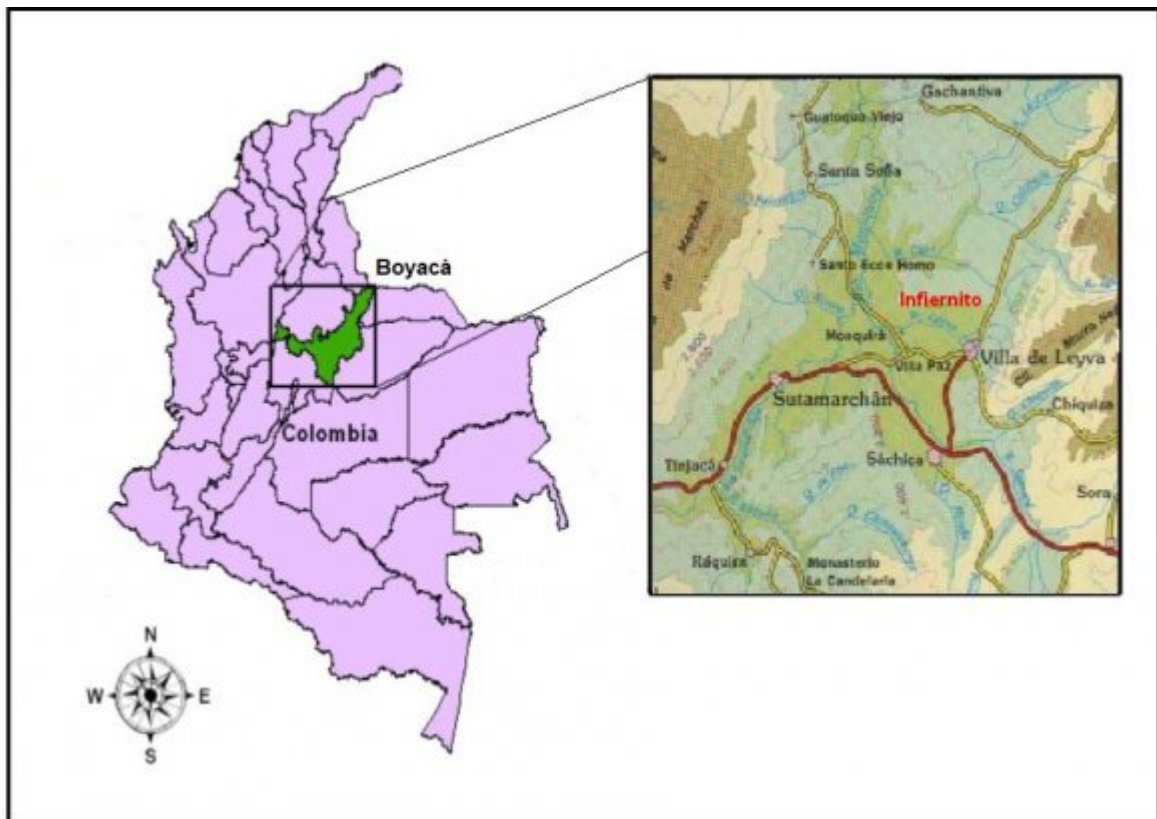


Figure 1:



Figure 2: Chiefdom



Figure 3: Chiefdom



1

Figure 4: Figure 1 :Chiefdom



23a

Figure 5: Figure 2 :Figure 3a :Chieftom



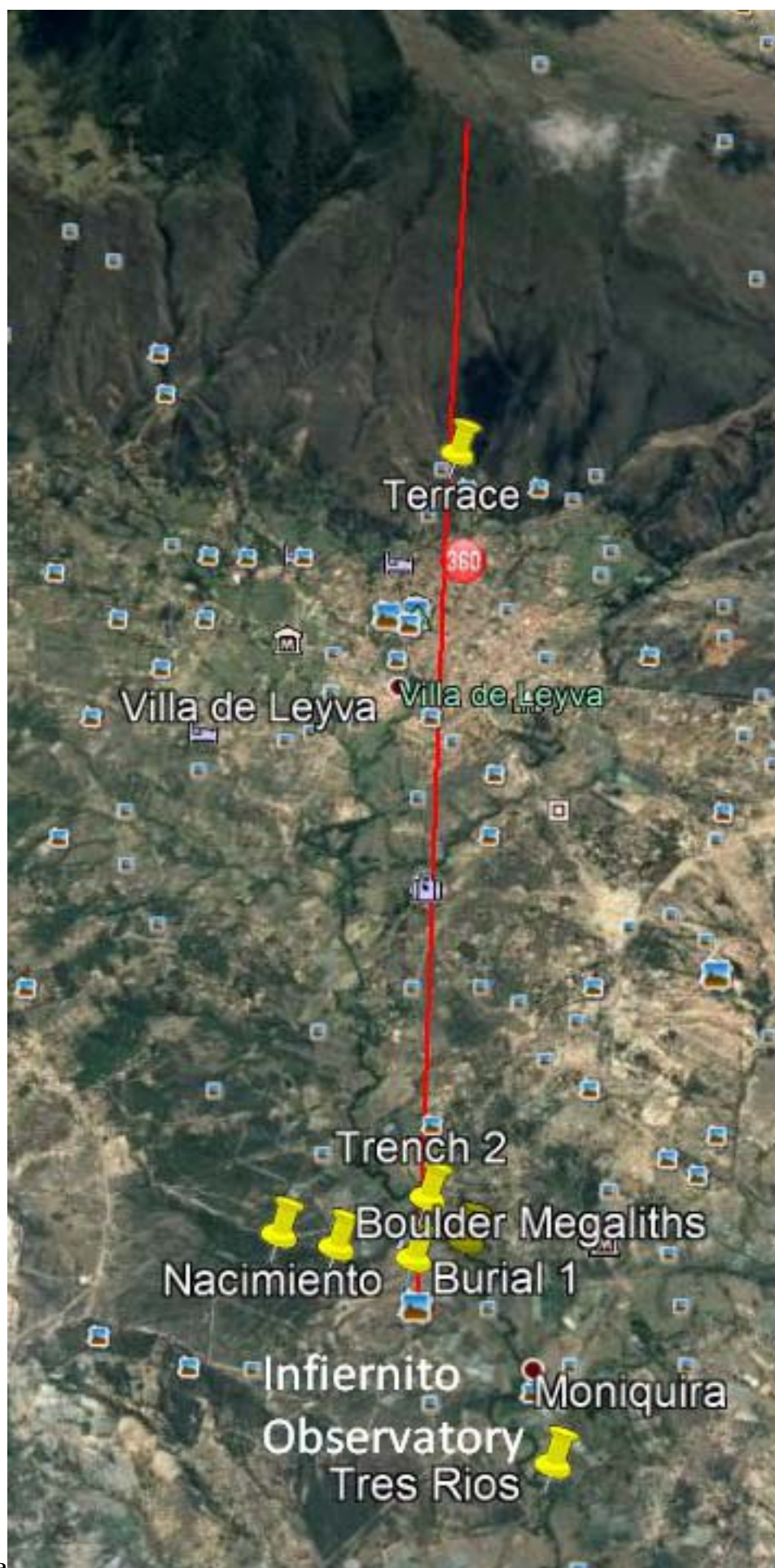
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Figure 6: Figure 4 :Figure 5 :ChiefdomChiefdomChiefdom



810a

Figure 7: Figure 8 :Figure 10a :



11a



12a

Figure 9: Figure 12a :



12b12c12d13

Figure 10: Figure 12b :Figure 12c :Figure 12d :Figure 13 :



Figure 11:



Figure 12:



Figure 13:



Figure 14:

**TERRACE PLATFORM
North Wall Profile**

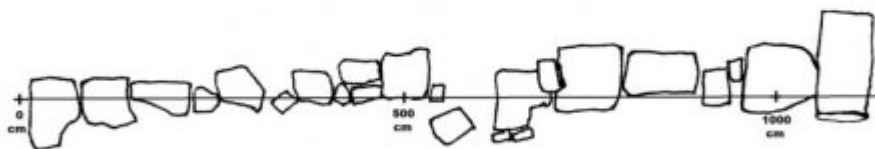


Figure 15:



Figure 16:



Figure 17:

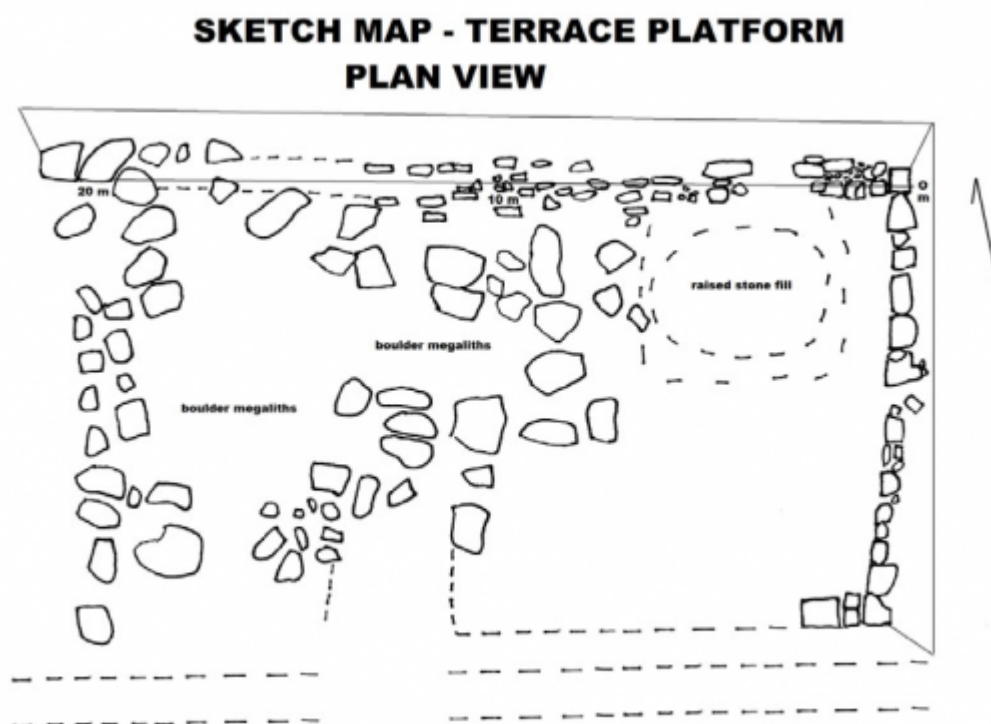


Figure 18:



Figure 19:



Figure 20:



Figure 21:



Figure 22:



Figure 23:



Figure 24:

.1 Acknowledgments

This research was funded by a grant from the National Geographic-Waitt Foundation (W352-14), contributions to the Foundation for Americas Research, Inc. and support from the University of Texas at Austin. I would like to thank the Awazako Family for their assistance in beginning this preliminary project. I greatly appreciate the expertise and valuable services of Timothy Beach, Eric Weaver, Luisa Aebersold, Greta Wells, Beth Cortwright, Nikki Woodward, Pedro Luis Suárez, Pilar Suárez Smyth, and Martha Esperanza Suárez. Also, the people of the beautiful Leiva Valley and City of Villa de Leyva were most helpful and cordial making our time there memorable and enjoyable.

[Acosta ()], Joaquin Acosta . www.lablaa.org/blaavirtual/letrab/bio/bio45.htm *Carta escrita a J. Jomard* 1850. 2005.

[Zerda ()], Liborio Zerda . 1882] 1972.

[Falchetti and Maria ()], Ana Falchetti, Maria . *Arqueología de Sutamarchán. Biblioteca Banco Popular* 1975.

[Nuesa (ed.) ()], Ingativa Nuesa . Reyes M. y V. Arenas V. (ed.) 2012. Boyacá: Villa de Leyva. p. . *Resignación Cosmogónica Muisca Chibcha en el Valle de Zaquenzipá. En Villa de Leyva Historia y Legado, Bicentenario de la Consolidación del Congreso Nacional*

[Henderson ()], Hope Henderson, Nicholas . Ostler 2005.

[Morales and David ()] 'Archaeoastronomy in the Muisca Territory'. Juan Morales, David . *Cosmology Across Cultures. ASP Conference Series* 2009. 409 p. .

[Langebaek ()] 'Arqueología regional en el Valle de Leiva: Procesos de ocupación humana en una región de los Andes Orientales de Colombia'. Carl H Langebaek . *Mercados, poblamiento e integración étnica entre los muisca, siglo XVI. Colección Bibliográfica*, (Bogotá; Bogotá) 1987. 1995. 2001. 20. University of Pittsburgh, Universidad de los Andes (Pittsburgh. 21) (Colección Informes Antropológicos. Instituto Colombiano de Antropología e Historia)

[Salamanca and Fernanda ()] *Asentamientos tempranos en el valle de Sáchica, Boyacá*, María Salamanca, Fernanda . 2000. Bogotá. Universidad de los Andes (Tesis de grado)

[Reichel-Dolmat ()] 'Astronomical Models of Social Behavior among Some Indians of Colombia'. Reichel-Dolmat . *Annals of the New York Academy of Sciences* 1982. 385 p. .

[Rivas and María ()] *Bases of Social Hierarchy in the Muisca Central Village of the Northeastern Highlands of Colombia*, Boada Rivas, Ana María . 1998. Pittsburgh. University of Pittsburgh

[Smyth ()] *Cambios Climáticos, Glaciares de Alta Altitud, y Ecodinámicos Humanos entre los Cacicazgos Colombianos de los Andes Orientales*, Michael P Smyth . 2014. Perú. (Ponencia para la Segunda Conferencia Intercontinental de la SAA en Lima)

[Comunicación científica preliminar En Memorias II Congreso de Antropología en Colombia. Tomo] 'Comunicación científica preliminar'. *En Memorias II Congreso de Antropología en Colombia. Tomo 1* p. . Descubrimientos arqueológicos en Villa de Leiva ; Universidad de Antioquia. Medellín

[Mangelsdorf ()] *Corn: Its Origin, Evolution, and Improvement*, Paul Mangelsdorf . 1974. Cambridge, MA: The Belknap Press of Harvard University Press.

[Cardenas-Arroyo ()] 'Datos sobre la alimentación prehispánica en la sabana de'. Cardenas-Arroyo . *Informes Arqueológicos de Instituto de Antropología e Historia* 2002. (3) .

[Words] 'Documents and Ethnology in the Study of Muisca Society'. Things Words, Text . 10.10007/978-4614-8724-1_12. *Against Typological Tyranny in Archaeology: A South American Perspective*, El Infiernito.

[Dorado] El Dorado . *Tomo II. Biblioteca Banco Popular*, (Bogotá)

[Dumbarton Oaks Research Library and Collection] *Dumbarton Oaks Research Library and Collection*, Washington, D.C.

[Gómez ()] 'Exploraciones Arqueológicas en San Agustín'. Duque Gómez, Luis . *Revista Colombiano de Antropología* 1964. (1) . Instituto Colombiano de Antropología, Imprenta Nacional

[Ferro ()] *Festejos Muisca en el Infiernito*, Salge Ferro, Manuel . 2007. Bogotá. Valle de Leyva: La consolidación del Poder Social. Universidad de los Andes

[Celis ()] 'Investigaciones arqueológicas en Villa de Leiva'. Silva Celis . Tunja. 34. 1981. *En: Boletín del Museo del Oro*, (Bogotá, Banco de la República) 1968. 1981. 4 p. . Las Estatuas de la Salina de Mongua. Libro Azul ; Universidad Pedagógica y Tecnológica

[Bernal ()] 'Jerarquía social de una comunidad en el valle de Leiva: unidades domésticas y agencia entre los siglos XI y XVII'. Fajardo Bernal, Sebastian . *Informes Arqueológicos del Instituto Colombiano de Antropología e Historia Número* 2011. 6.

[Beach (2015)] *Keynote on Soil and Sediment Transfers in Middle America at the PAGES working group on Global Soil and Sediment Transfers in the Anthropocene (GloSS) at the Department of Geography*, Timothy Beach, S . 2015. 19th -21st Aug. 2015. University of Bonn, Germany.

- [Botiva ()] 'La altiplanicie cundiboyacense'. Alvaro Botiva . *Colombia prehispánica-Regiones arqueológicas*, (Santa F  de Bogot ) 1989. p. . Instituto Colombiano de Antropolog a
- [Beach et al. ()] 'Landscape Formation and Agriculture in the Wetlands of Northwestern Belize'. Timothy Beach , Sheryl Luzzadder-Beach , Jon Lohse . *Classic Maya Political Ecology*, Jon C Lohse (ed.) 2013.
- [Livestock Farming in the Saquencip  Valley, New Kingdom of Granada, Colombia in the 16th and 17th Centuries Pastos ()] 'Livestock Farming in the Saquencip  Valley, New Kingdom of Granada, Colombia in the 16th and 17th Centuries'. *Pastos* 2015. 42 (2) p. .
- [Los cacicazgos muisca a la llegada de los conquistadores espa oles-El caso de zacazgo o "reino" de Tunja ()] *Los cacicazgos muisca a la llegada de los conquistadores espa oles-El caso de zacazgo o "reino" de Tunja*, 1985. Tesis de grado, antropolog a, Universidad de los Andes
- [Drennan ()] 'Mortuary Practices in the Alto Magdalena: the Social Content of the San Augustin Culture'. Robert Drennan . *Tombs for the Living: Andean Mortuary Practices*, T Dillehay (ed.) 1995. p. .
- [Muisca Settlement Organization and Chiefly Authority at Suta, Valle de Leyva, Colombia: A Critical Appraisal of Native Concepts of House for Studies of Complex Societies]. *Journal of Anthropological Archeology* 24 p. .
- [Patrones de asentamiento regional y sistemas de agricultura intensiva en Cota y Suba] *Patrones de asentamiento regional y sistemas de agricultura intensiva en Cota y Suba*, Sabana de Bogot , (Colombia), FIAN, Banco de la Republica; Bogot .
- [Wells et al. ()] 'Preliminary soil erosion and sediment budgets in the Valley of Leyva, Boyac , Colombia. Poster paper in preparation for the'. G Wells , L Aebersold , T Beach , M Smyth . *Annual Meeting in*, (Baltimore, MD) 2015. Geological Society of America.
- [Pr cticas agropecuarias coloniales y degradaci n del suelo en el Valle de Saquencip , Provincia de Tunja, siglos XVI y XVII] *Pr cticas agropecuarias coloniales y degradaci n del suelo en el Valle de Saquencip , Provincia de Tunja, siglos XVI y XVII*, Bogot . Universidad Nacional de Colombia
- [Pacheco ()] 'Pr cticas Agr colas Coloniales y Degradaci n del Suelo: El Caso de Saquencip . Revistaeogr fica de Am rica Central'. Mora Pacheco , KG . *Numero Especial EGAL* 2011. p. .
- [The Evolution of Social Hierarchy in a Muisca Chiefdom of the Northern Andes of Colombia] *The Evolution of Social Hierarchy in a Muisca Chiefdom of the Northern Andes of Colombia*, Pittsburgh. University of Pittsburgh Memoirs in Latin American Archaeology
- [Kruschek ()] *The Evolution of the Bogota Chiefdom: A Household View*, Michael Kruschek . 2003. Pittsburgh. University of Pittsburgh
- [Smith ()] 'The Recovery of Plant Remains from Intermediate Area Sites'. Earle Smith . *Diet and Subsistence: Current Archaeological Perspectives*, B V Kennedy, G M Le Moine (ed.) (Calgary) 1988. p. . The University of Calgary
- [Broadbent ()] 'Universidad Nacional de Colombia, Bogot . 10. 1968 A Prehistoric Field System in Chibcha Territory'. S Broadbent . *Colombia. Nawpa Pacha* 1964. 6 p. . (Los Chibchas. Organizaci n socio-pol tico)
- [Enciso y M. Therrien. ICANH (ed.)] *Variabilidad mortuoria y organizaci n social muisca en la sabana de Bogot *, Enciso y M. Therrien. ICANH (ed.) Bogot . (En Sociedades complejas de la sabana de Bogot , siglos VII al XVI d. C)
- [Restrepo] *Vicente 1895/1972 Los chibchas antes de los conquista espa ola-Atlas y Anexo arqueol gicos*, Biblioteca Banco Popular, Restrepo . Bogot .
- [Michael and Beach] 'Weaver in press Climate Change and Chiefdom Ecodynamics in the Eastern Andean Cordillera of Colombia'. Smyth Michael , P , Timothy S Beach , EricM . *Changes in Latitudes, Changes in Attitudes: Transitions and Thresholds throughout Central America and Beyond. Occasional Papers of the Center for Archaeological and Tropical Studies*, University of Texas-Austin