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Project Gallery

Geoglyphs in the Andean Central Coast: combining digital and traditional survey techniques

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This Andean coast research has identified 113-plus geoglyphs spanning the Formative (1800–100 BC) to the Inka period (AD 1470–1532). The project combined digital technology and Remotely Piloted Airborne Systems to locate the sites. The authors also documented examples of ceramics and intricate road systems and suggest that the finds represent meticulously ritualised landscapes.

Keywords: Andes, Formative and Inka periods, geoglyphs, Remotely Piloted Airborne Systems, embedded religiousness

Introduction

The middle Chillón valley, situated on the Andean central coast (Figure 1), has been the subject of extensive scholarly investigation for nearly half a century (Dillehay 1976; Silva 1996); however, the deep ravines that traverse into the valley remain relatively unexplored. Research undertaken from 2019–2024 has revealed geoglyphs dating from the Formative (1800–100 BC) to the Inka period (AD 1470–1532). Documenting these large-scale (minimum of 4m in length) examples of land art presents methodological challenges, but digital technology and the use of Remotely Piloted Airborne Systems (RPAS) prove effective solutions.

Through the use of publicly accessible satellite images (Google Earth), photogrammetric drone surveys and systematic field surveys, we have successfully recorded 113 previously undocumented geoglyphs representing a varied typology.

Geoglyphs in southern Peru are usually found in the Andean region, particularly in the Nasca and Palpa areas (Lambers 2006; Sakai *et al.* 2014); they are also present on the north coast (Alva & de Alva 1982; Pozorski *et al.* 1991; Shady *et al.* 2003), but there is limited information about the central coast. Our research challenges this geographic confinement and the findings indicate a high concentration of geoglyphs on the central Peruvian coast—most notably in the Chillón river valley, focus of our research. Information pertaining to the central coast has been limited to the Rimac river valley (Rosello 1997; Abanto 2009)

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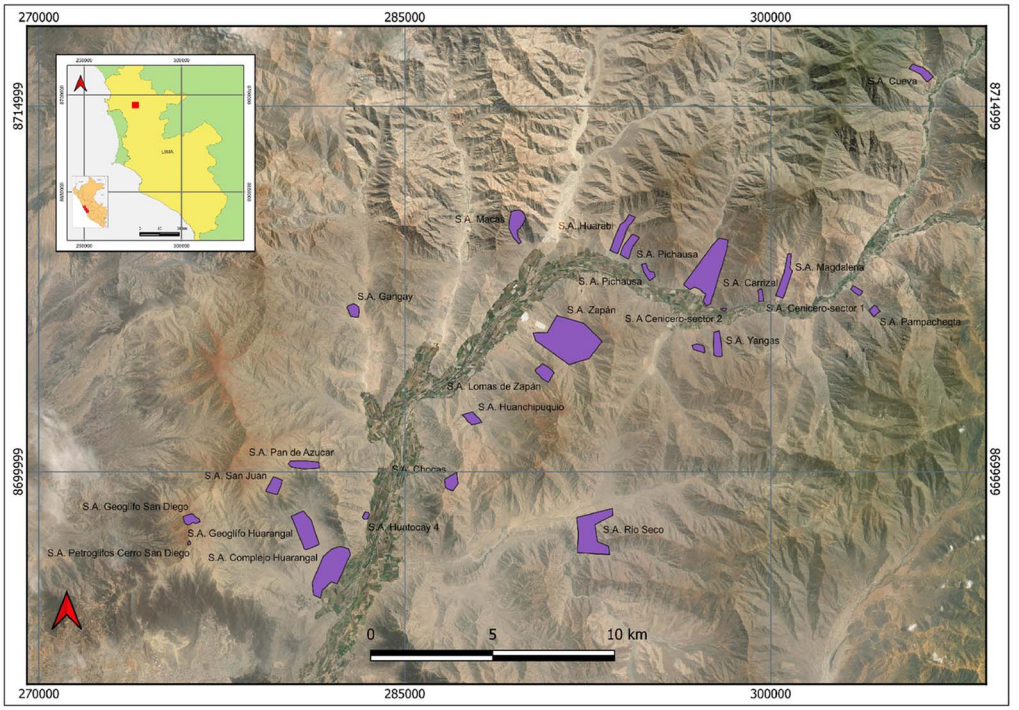

Figure 1. Middle Chillón valley and the areas surveyed (figure by authors).

and a small number of sites in the Chillón river valley: San Diego, Torre Blanca and Macas (Rodríguez 1999; Palacios 2017).

Comprehensive recording in the middle Chillón valley

Along the Chillón river, 113 previously unreported geoglyphs have been documented (Figure 2). Linked with examples of ceramics, intricate road systems and other evidence, these findings suggest meticulously ritualised landscapes. Formative and Wari geoglyphs were situated near ceremonial and administrative centres, whereas those associated with regional states and Inka sites were in proximity to crossroads and formal pathways. The investigation primarily focused on identifying geoglyphs and their associated elements by analysing spatial, morphological and visual aspects through a multiscale remote sensing methodology. Similar research methodologies have been successfully applied in other regions (e.g. Lasaponara & Masini 2012; Lambers 2020), which influenced our chosen approach.

Furthermore, this research methodology yields georeferenced maps that are crucial for on-site investigations. The digital maps can be seamlessly integrated into GPS and mobile devices (Chen *et al.* 2017; Abate & Lasaponara 2019), offering a practical advantage when undertaking ground survey such as real-time navigation and enhanced accuracy. This information is particularly valuable for geoglyphs situated in challenging or remote areas or those that have undergone alterations due to reasons such as urban development.

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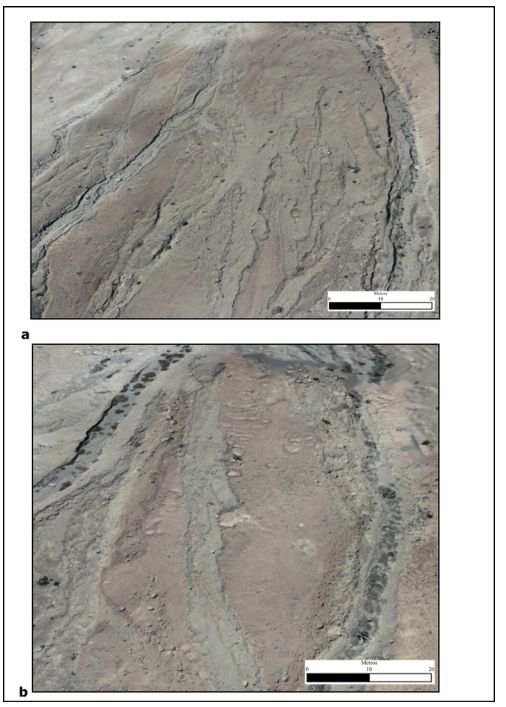

Figure 2. Huarabi Geoglyphs, Formative Period: a) geoglyph 1; b) geoglyph 2. Images taken using RPAS (figure by authors).

The identification of geoglyphs began with examining Google Earth satellite images. Initially, we noted terrain irregularities suggesting 'potential' geoglyphs. We then used RPAS—Mavic 1 drones and PHANTOM 4 PRO—for verification. Images captured at 30–70m had resolutions of 10mm/pixel (Mavic 1) and 30mm/pixel (PHANTOM 4 PRO). These images were processed with Agisoft Metashape software to generate 3D orthophotos.

The final phase involved a comprehensive field survey for validation, correction and documentation of the material culture associated with the identified geoglyphs. This integrated approach, including satellite imagery analysis, RPAS utilisation and field surveys, ensured a robust and multifaceted methodology for geoglyph identification and analysis.

Results

This methodology facilitated the documentation of more than 113 geoglyphs across 19 archaeological sites (see Table S1 in online supplementary materials). The ceramics found at each site were not employed as an exact chronological indicator. Instead, their presence allows for cautious inferences to be drawn regarding the relative chronology of the geoglyphs and, possibly, their final use. However, initial analysis of the ceramics identified one site from the Formative period (1800–100 BC), four from the Regional Development period (100 BC–AD 900), one from the Wari period (AD 900–1270), and 16 from the Regional States and Inka periods (AD 1270–1532) (Figures 3 & 4). Subsequent studies should consider other factors for refining chronologies, such as cultural reuse, post-depositional and taphonomic events that may have influenced the distribution of these ceramics.

Nonetheless, it is important to note that geoglyphs tentatively linked with Formative ceramics are situated near U-shaped buildings, such as at Chocas and Pucara, which were pervasive religious/ceremonial structures during the Formative period (Williams 1980). The geoglyph from the Wari period is most likely affiliated with the Wari site of Macas, while those from the Regional State and Inka periods are aligned with both primary and subordinate crossroads (Figure 5).

Geoglyphs served as a profound cultural expression of the communities residing in the middle valley of the Chillón river. These manifestations of cultural lifeways intricately incorporate vast expanses of wilderness and desert into their belief system. Through deliberate and meticulous landscape modifications, these geoglyphs were strategically positioned to be

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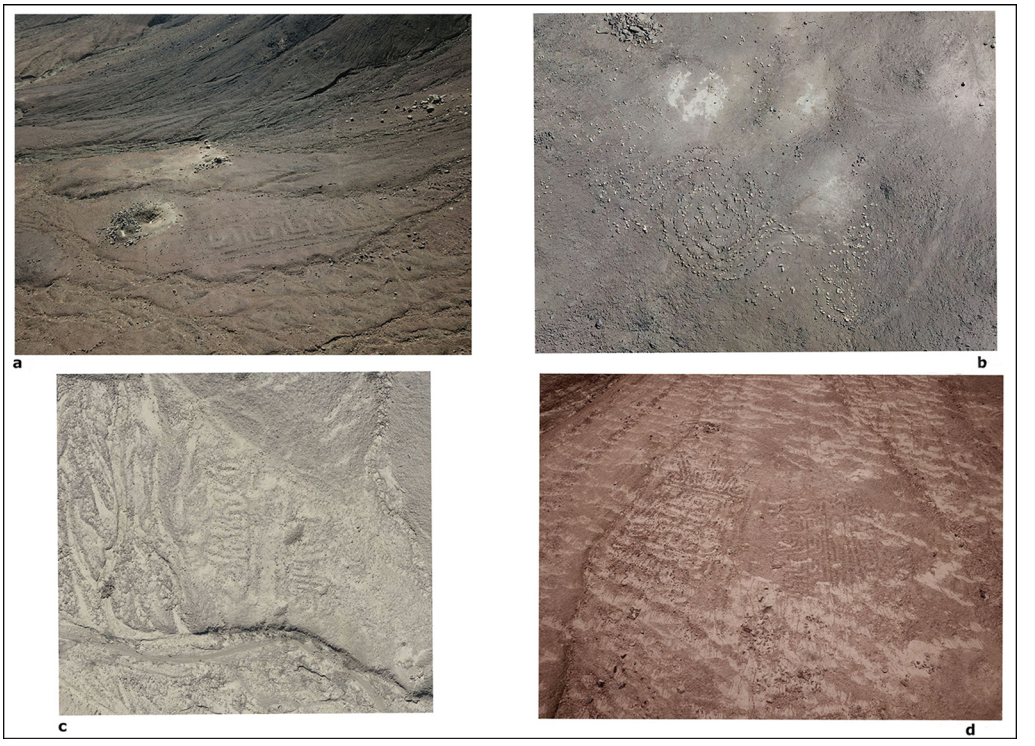

Figure 3. a & b) Macas, Wari period; c & d) Zapan, regional states and Inka periods. Images taken using RPAS (figure by authors).

visited by multiple communities, thereby fostering a cohesive integration of different polities (Schwimer *et al.* 2024).

Owing to their geographic isolation, the geoglyphs remain unaffected by modern alterations. The recorded paths seem to connect the valley inhabitants solely to the geoglyphs, given the absence of other pre-Hispanic constructions nearby. Thus, the geoglyphs and paths likely formed a highly significant space used by the middle-valley inhabitants of the Chillón river for various rituals.

In Andean societies, religion intertwines with economic, political, corporate and domestic activities, a concept known as Embedded Religiousness (Mesia-Montenegro & Sanchez-Borjas 2023). Sacralising landscapes through religious markers such as geoglyphs is central to this. These markers hold religious and political significance, serving as cultural boundaries or convergence points, deeply embedding religion into daily life.

Conclusions

Geoglyphs have played a pivotal role in shaping the cultural and physical landscape of central Andes coast societies, with the middle Chillón valley serving as a poignant testament to the profound significance and coexistence of geoglyphs alongside ceremonial spaces, such as Formative U-shaped buildings or Wari sites such as Macas, or intricate road systems. The

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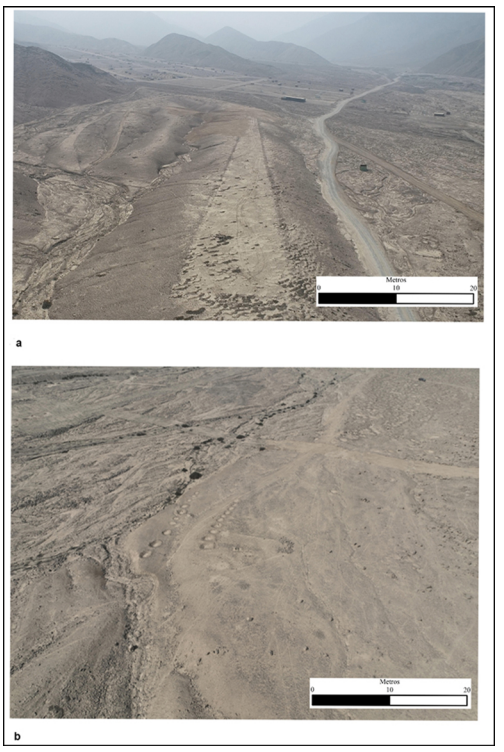

Figure 4. a) Gangay, regional states and Wari periods; b) Algodonales, regional states and Wari periods. Images taken using RPAS (figure by authors).

archaeological evidence suggests that the practice of constructing geoglyphs in the middle valley of the Chillón river might have persisted for more than 3000 years.

Unfortunately, the ongoing rapid and disorganised urban development this century in the region poses a significant threat to these previously unreported geoglyphs. Preserving this invaluable cultural heritage necessitates strict adherence to established heritage-preservation regulations. The studied area not only boasts a rich array of geoglyphs but also encompasses a wealth of surface material culture, including ceramics and pre-Hispanic roads, some potentially linked to the Inka Road system (e.g. Hyslop 1984). Moreover, the potential existence of similar sites in other valley segments cannot be dismissed.

To address these potential discoveries, it is crucial to broaden the scope of research within the valley. This involves exploring intra-valley communications via ravines, utilising a combination of RPAS and traditional survey techniques. Such an expanded research approach promises to contribute to a rounded understanding of the region's cultural heritage and will play a vital role in formulating effective preservation strategies.

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Online supplementary materials (OSM)

To view supplementary material for this article, please visit https://doi.org/10.15184/aqy.2024.130 and select the supplementary materials tab.

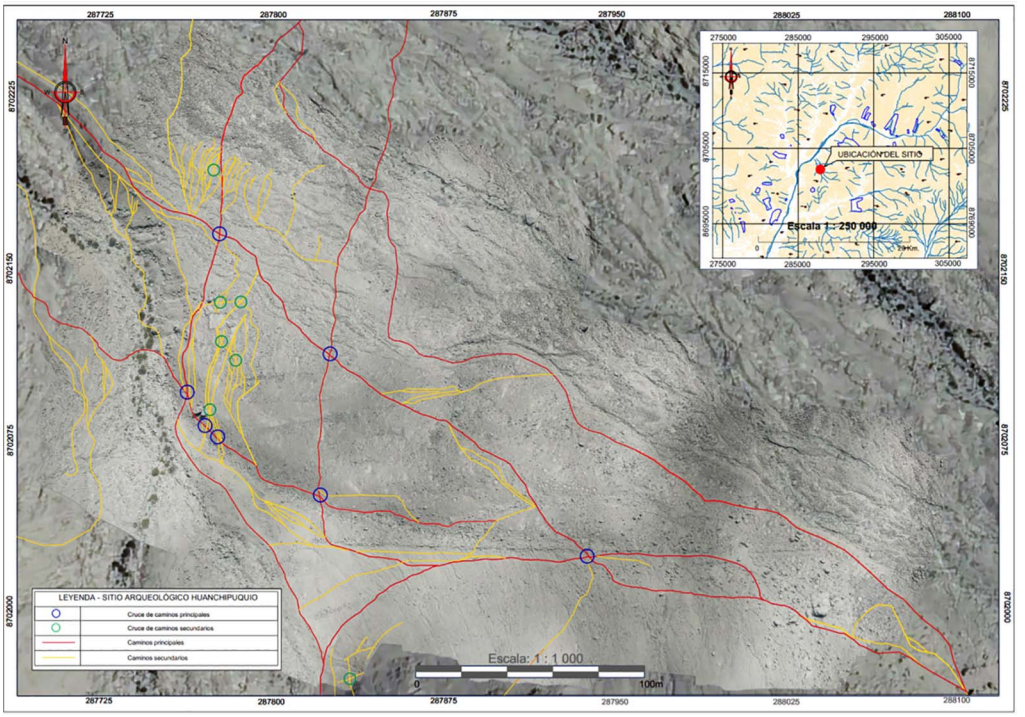

Figure 5. Pre-Hispanic road system associated with Huachipuquio. Image taken using RPAS (figure by authors).

References

Abanto, J. 2009. Evidencias arqueológicas del Periodo Formativo en la quebrada de Canto Grande, valle bajo del Rímac. *Boletín de arqueología PUCP*: 159–85. https://doi.org/10.18800/boletindearqueologiapucp.200901.005

Abate, N. & R. Lasaponara. 2019. Preventive archaeology based on open remote sensing data and tools: the cases of Sant' Arsenio (SA) and Foggia (FG), Italy. *Sustainability* 11: 4145. https://doi.org/10.3390/su11154145

Alva, W. & S.M. de Alva. 1982. Geoglifos del Formativo en el valle de Zaña. *Beiträge zur Allgemeinen und Vergleichenden Archäologie* 4: 203–12.

Chen, F., R. Lasaponara & N. Masini. 2017. An overview of satellite synthetic aperture radar remote sensing in archaeology: from site detection to monitoring. *Journal of Cultural Heritage* 23: 5–11. https://doi.org/10.1016/j.culher.2015.05.003

Dillehay, T.D. 1976. Competition and cooperation in a pre-Hispanic multi-ethnic system in the Central Andes. Unpublished PhD dissertation. Austin: University of Texas at Austin.

Hyslop, J. 1984. *The Inka Road system*. Orlando (FL): Academic Press.

Lambers, K. 2006. *The geoglyphs of Palpa, Peru: documentation, analysis, and interpretation*. Aichwald: Linden Soft.

– 2020. Walking and marking the desert: geoglyphs in arid South America, in V. Klinkenberg, R. van Oosten & C. van Driel-Murray (ed.) *A human environment: studies in honour of 20 years Analecta editorship by Prof. Dr. Corrie Bakels*. Leiden: Sidestone Press.

Lasaponara, R. & N. Masini. 2012. Remote sensing in archaeology: from visual data interpretation to digital data manipulation. In *Satellite remote*

https://doi.org/10.15184/aqy.2024.130 Published online by Cambridge University Press

sensing: a new tool for archaeology: 3–16. Cham: Springer. https://doi.org/10.1007/978-90-481-8801-7_1

Mesia-Montenegro, C. & A. Sanchez-Borjas. 2023. Embedded religiousness and the Kotosh religious tradition in highland Peru: the site of La Seductora. *Antiquity* 97: 367–85. https://doi.org/10.15184/aqy.2023.17

Palacios, J. 2017. *Agua: Ritual y Culto en Yañac (Ñaña): La Montaña Sagrada*. Universidad Peruana Unión: Fondo Editorial.

Pozorski, T., S. Pozorski, & J. Rick. 1991. A bird geoglyph near Casma, Peru. *Andean Past* 3: 87–192.

Rodríguez, A.R. 1999. Reconocimiento aero-arqueológico del complejo de geoglifos de la quebrada Torreblanca, Valle de Río Chillón, Costa Central del Perú. *Boletín del Instituto Riva-Agüero* 26: 297–314.

Rosello, L. 1997. *Canto Grande y su relación con los centros ceremoniales de planta en U*. Lima, Peru: Mundo Gráfico.

Sakai, M., J. Olano, Y. Matsumoto & H. Takahashi. 2014. *Centros de Líneas y Cerámica en las Pampas de Nasca, Perú 2010*. Yamagata: Yamagata University Press.

Shady, R., M. Machacuay & R. Aramburú. 2003. Un geoglifo de estilo Sechín en el valle de Supe. *La ciudad sagrada de CaralSupe. Los orígenes de la civilización andina y la formación del Estado prístino en el antiguo Perú*: 303–11.

Silva, J.E. 1996. *Prehistoric settlement patterns in the Chillón river valley, Peru*. PhD dissertation. Ann Arbor: Department of Anthropology, University of Michigan.

Schwimer, L., R. Galili, N. Porat, G. Bar-Oz, D. Nadel & S.A. Rosen. 2024. The constructed desert: a sacred cultural landscape at Har Tzuriaz, Negev, Israel. *Cambridge Archaeological Journal* 34: 271–89. https://doi.org/10.1017/S0959774323000276

Williams, C. 1980. Complejos de pirámides con planta en U: Patrón arquitectónico de la costa central. *Revista del Museo Nacional* 44: 95–110.