

**ANCIENT BLOOD... PRESUMPTIVE BLOOD TESTING WITH BLUESTAR® FORENSIC ON  
800 YEARS OLD ARCHAEOLOGICAL CONTEXTS,  
ANTOFAGASTA DE LA SIERRA, SOUTH HIGHLANDS (PUNA) OF ARGENTINA**

*by Sara López Campeny y Andrés Romano*

*Consejo Nacional de Investigaciones Científicas y Técnicas,  
Instituto Superior de Estudios Sociales (ISES-CONICET)  
Instituto de Arqueología y Museo, Universidad Nacional de Tucumán (IAM-UNT)*

The results obtained from a series of presumptive tests of latent blood (Spalding 2006) are presented. These test were carried out in November 2017, in the Higher Institute of Social Studies (Sp. *Instituto Superior de Estudios Sociales*, ISES) that is part of the Technological Scientific Center of National Council of Scientific and Technical Research (Sp. *Centro Científico y Tecnológico del Consejo Nacional de Investigaciones Científicas y Técnicas*, CCT-CONICET) of the province of Tucumán.

The analysis was carried out on two archaeological artifacts: a ceramic container and a textile fragment recovered within that ceramic piece. The fabric, which had been previously folded, was deposited in the interior of the ceramic vessel, and then covered with a sedimentary filling material and had an intense red-colored pigmentation. In the filling sediment, inside the vessel, a high density of tiny quinoa seeds *Chenopodium quinoa* Wild. (*Chenopodiaceae*), which have been dated by the AMS technique in ca. 800 years BP<sup>1</sup> (López Campeny et al. 2015), was recovered (Babot et al. 2015; Winkell et al. 2015).

Both elements and their associated context come from the archaeological locality of Punta de la Peña (geographical coordinates: 26° 1' 40.96" S y 67° 20' 37.39" W) within the micro region of Antofagasta de la Sierra (onwards ANS), included in the geographical sector of the Southern Highlands (Sp. *Puna*) of Argentina<sup>2</sup>. With an altitude that ranges between 3600 to 4200 masl (meters above sea level) and a biogeography that corresponds to the highland desert, the micro-region of ANS constitutes a succession of "oasis" in this Puna environment, due to the presence of an endorheic basin and a series of permanent narrow water courses (Aschero 1999).

---

<sup>1</sup> Radiocarbon age determination effected in the AMS Lab of the University of Arizona, Tucson (AA105653, <sup>14</sup>C age: 796 ± 24 YBP; calibrated date: 1225 to 1288 cal. years AD, 95,4% probability, OXcal v.4.2.4, SHCal13 atmospheric curve, Hogg et al. 2013).

<sup>2</sup> These archaeological materials were recovered in the framework of Research Projects directed by Lic. Carlos Aschero (Principal Researcher CONICET-ISES); and the textile evidences and their associated contexts are being analyzed by Dr. Sara M. L. López Campeny (Associate Researcher CONICET-ISES) and Andrés S. Romano (SINEP CONICET-ISES).



**Map showing the geographical location of Antofagasta de la Sierra, Catamarca, Argentina**

The reagent selected for the presumptive blood testing was Bluestar® Forensic<sup>3</sup> due to its extreme sensitivity, even when the blood is in a very low concentration, or in cases where the blood has been washed out, altered and/or diluted; or even when the blood is not fresh; it presents a stronger and longer-lasting chemiluminescence than other products, which does not require total darkness to be visible, and which can also be differentiated from a false positive (by its color, intensity and duration) and mainly because it does not alter the DNA of the revealed blood, which allows that the surface that reacted positively to the reagent can be re-used in further blood residue and subsequent genetic studies on the sample (DNA and ABO typing) leading to determine the specific origin of blood. Furthermore, it is safe and easy to prepare and use, has a very long shelf-life and does not need any special storage condition (Webb 2006; Giraldo et al. 2013; and attached documentation from the BlueStar® Forensics website: <http://www.bluestar-forensic.com>).

The photographic record of the procedure and results, as well as the *ad hoc* methodology and protocol that were designed for this purpose, were carried out by the University Photography Technician Marcela Alonso (SINEP CONICET-ISES). She is a member of the Digitalization Laboratory of the CCT Tucumán (Sp. *Laboratorio de Digitalización* based in ISES), under the responsibility of photographer C. Darío Albornoz (CPA CONICET-ISES). A NIKON D610 reflex camera equipped with a 28/200 mm lens was used, which was fixed on a tripod. The photographs were taken in RAW format and were taken to the two artifacts, immediately before and just after spraying their surfaces with

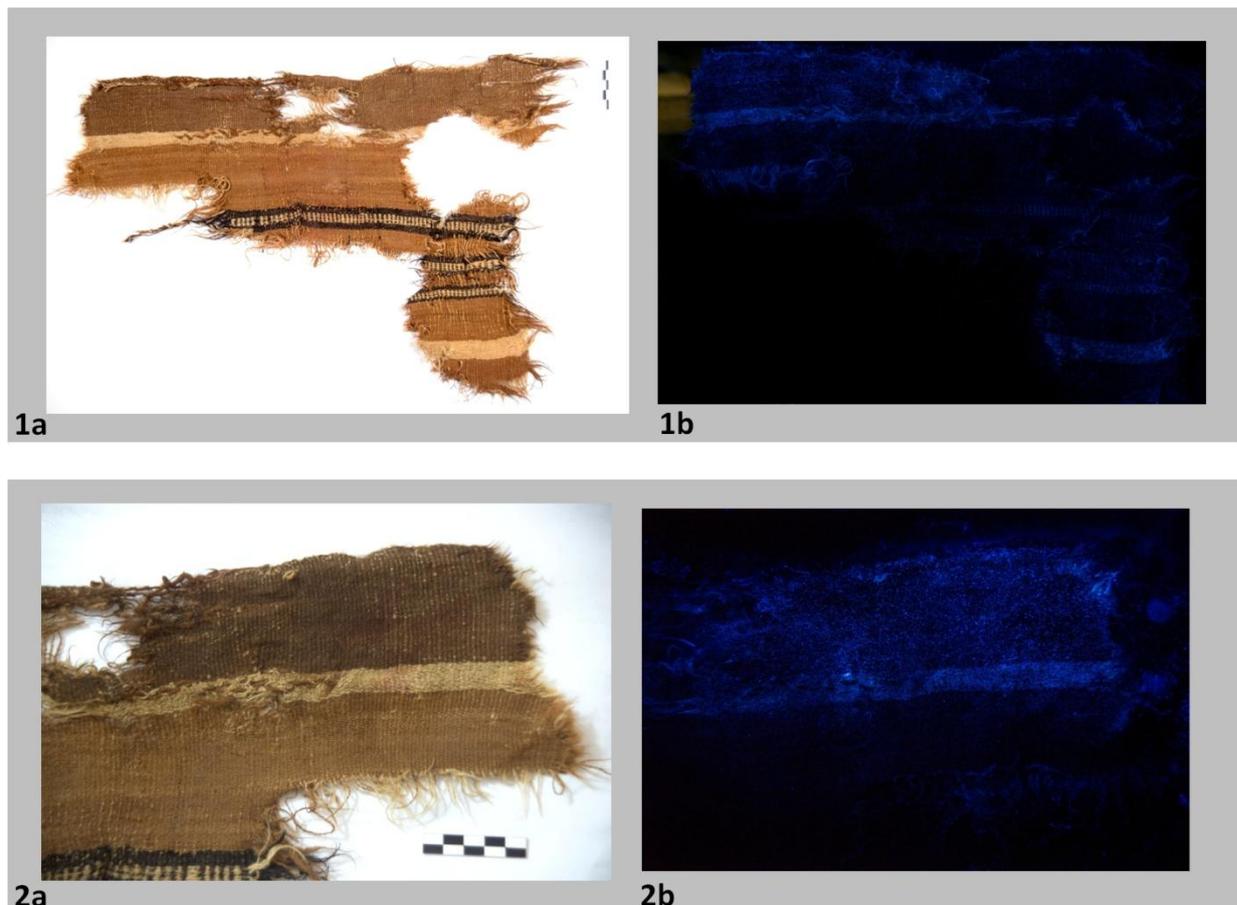
---

<sup>3</sup> In this case it was use the water soluble tablets presentation: four tablets of the Bluestar® Forensic are combined in a spray bottle with 250 ml of distilled water.

the reagent. In the first case, in conditions of artificial light and in the second one in darkness, but in none of these situations the camera flash was used<sup>4</sup>.

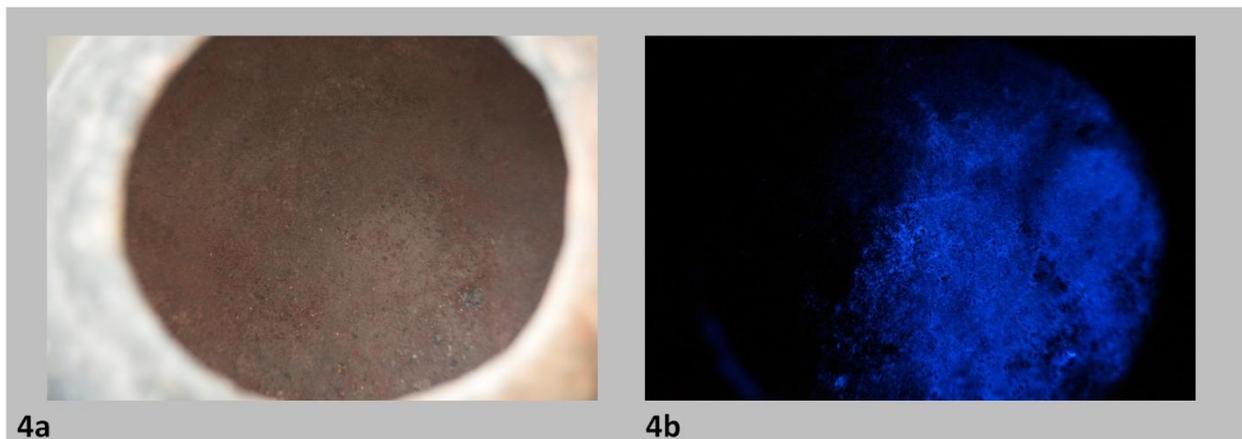
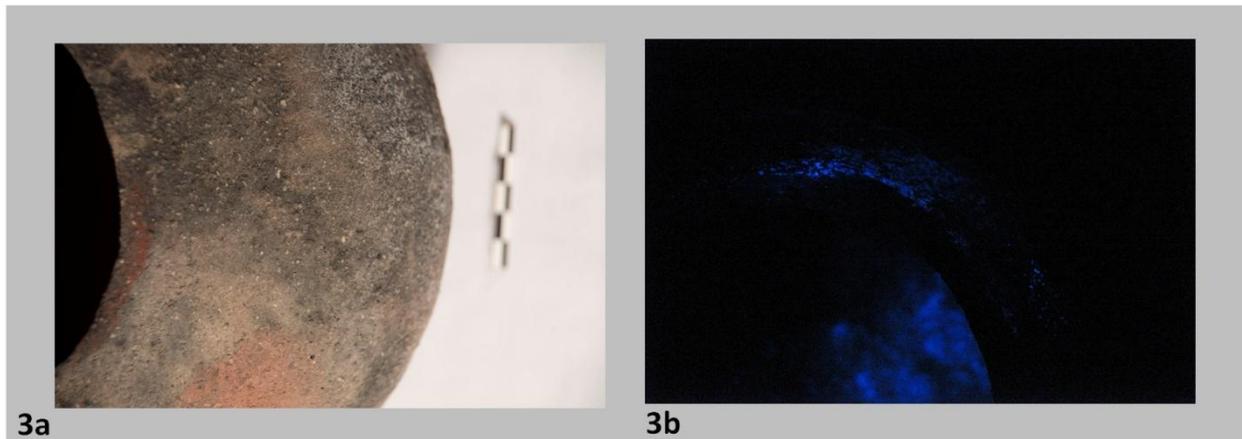
As it can be observed in the images that we present below a blueish quimioluminescence, which is clearly observed in certain areas of the textile and the vessels, in darkness conditions, indicates a positive result for blood stains in the case of both artifacts. The reaction time was recorded between 1-2 seconds (start) to 90 -120 seconds (permanence)<sup>5</sup>.

The result of the test with the Hexagon OBTI kit, for a sample that was collected from an area of the textile that presented chemiluminescence, was negative for determination of presence of human blood. We interpret this negative result in consistency with the historical, ethnographic and archaeological information that we cite below. However, there is a possibility that the Hexagon OBTI test has been negative because of issues having to do with sample conservation, due to the age of the blood and the inherent limitations of the test, originally designed for studies on fresh material. It is due to this that it is planned to carry out further analyses (DNA typing) to determine specifically the origin of the blood present.



<sup>4</sup> The camera settings to register the luminescence, in dark conditions, were: exposition time: 30 s; velocity: ISO 100 – ISO 250; and focal aperture: f/3.2 to f/6.3.

<sup>5</sup> The results were confirmed by Juan O. Ronelli - 2nd Chief of Chemical Laboratory Division of the Argentine Federal Police (PFA) and Professor of the PFA University Institute.



**Observation before (left) and after (right) of the application of Bluestar® Forensic on the artifacts: (1) textile: general view, (2) textile: detail of a sector, (3) ceramic vessel: sector of rim and external wall and (4) ceramic vessel: internal base**

The implications of these results are multiple and can be included in two major aspects:

From a methodological point of view, they allow to extend the field of application of the product to Archeology<sup>6</sup>, since the reagent has been developed and has been used almost exclusively for crime scene investigations, in forensic labs. Also, our results extend notably the temporal depth of its use, if we consider that the test on older materials, reported by the official website of the product, corresponds to the nineteenth century<sup>7</sup>, while the archaeological context of Antofagasta de la Sierra has been dated in the thirteenth century by the AMS method, that is, about 600 years before.

<sup>6</sup> Its possibilities of use in the discipline have been evaluated by Barbara J. Gundy (2008), who performed blind tests based on the application of Bluestar® Forensic in replicated archaeological lithic artifacts, more specifically a set of expedient flakes.

<sup>7</sup> Battle of Gettysburg, United States Civil War (1863) (<http://www.bluestar-forensic.com/gb/bluestar-oldblood.php>)

On the other hand, from an interpretative perspective, the results show the ancestrality and permanency of certain Andean ritual practices, which have been frequently documented in historical and ethnographic sources, but are "invisible" to the naked eye from the archaeological materiality. We are referring to the frequent mention, in the specific literature, of the ritual use of blood, organs or parts of animals -especially camelids- during pastoral fertility propitiation ceremonies (Flores Ochoa 1974; Gordillo Condorí 1998, Lecoq y Fidel 2000, Murgía Sánchez 2000, inter alia). In this sense, other elements of the archaeological context had led us to propose their relationship with practices of a ritual nature due to the very particular agency that these attributes have in the Andes. We refer to the particular placing of the finding recovered in a sector of the *Pampa* or platform on top of the rocky outcrop of Punta de la Peña, the identification of a series of magical religious attributes associated with the textile such as insertion of a set of left-plied yarns (Sp. *Hilo zurdo* or else *llok'e*, from the Quechua *lluq'i*.) and yarns made of human hair, and the intentional filling with reddish sediment, among the main ones (López Campeny 2014, López Campeny et al. 2015).

The recent positive results of the presumptive blood testing, which revealed blood stains in the textile and in its container, provide new evidence for the sustenance of these interpretations.

### **Acknowledgments**

Our gratitude to the Institutions that provided the academic framework and financial support for the research: the National Council for Scientific and Technical Research (CONICET); the Higher Institute of Social Studies (ISES); the National Agency for Scientific and Technological Promotion (ANPCyT). We are very grateful to the members of the ISES Digitalization Laboratory: Marcela Alonso and Darío Albornoz, for their professionalism and enthusiasm to develop the experience. We specially thank Juan O. Ronelli (Chemical Laboratory Division of the Argentine Federal Police), for his kindness and generosity to share his expertise. Finally, we thank Professor Norma Beatriz Pino (National University of Tucumán) for reviewing the translation of the manuscript.

### **References:**

ASCHERO, C. A. 1999. El arte rupestre del desierto puneño y el noroeste argentino. In: *Arte Rupestre en los Andes de Capricornio*, pp. 97-135, Museo Chileno de Arte Precolombino y Banco de Santiago, Chile.

BABOT, M. P.; AGUIRRE, M. G.; ARIZIO, C. M.; ASCHERO, C. A.; BERTERO, H. D.; COSTA-TÁRTARA, S.; HOCSMAN, S.; JOFFRE, R.; LÓPEZ CAMPENY, S. M. L.; MANIFIESTO, M. M.; WINKEL, T. 2015. Diversidad genética de Quinoa en los últimos dos milenios: primer caso de estudio en Antofagasta de la Sierra (Puna de Catamarca, Argentina). In: *Libro de Resúmenes del V Congreso Mundial de Quinoa y II Simposio Internacional de Granos Andinos*, p. 185, San Salvador de Jujuy, Argentina.

FLORES OCHOA J. A. 1974. Enqa, Enqaychu illa y Khuya Rumi: aspectos mágico-religiosos entre pastores. In: *Journal de la Société des Américanistes*, Tome 63: 245-262; doi: 10.3406/jsa.1974.2129 [http://www.persee.fr/doc/jsa\\_0037-9174\\_1974\\_num\\_63\\_1\\_2129](http://www.persee.fr/doc/jsa_0037-9174_1974_num_63_1_2129)

GIRALDO, E.; ESPINOSA, T.; LEZCANO, N.; ZULUAGA, D.; CLAVIJO, Y.; HERRERA, T. y VALENCIA, K. 2013. Efecto del Bluestar forensics® sobre las pruebas preliminares y de análisis de ADN en la investigación de manchas de sangre. *Revista Facultad de Ciencias Forenses y de la Salud*. N°. 9: 9-21. Tecnológico de Antioquia, Medellín, Colombia.

GORDILLO CONDORÍ, V. 1998. La llama en la crianza de las comunidades humanas. In: *La Crianza Mutua en las Comunidades Aymaras*, Apaza Ticona, J.; Gordillo Condori, V.; Cutipa, S. pp. 47-87. Asociación Chuyma de Apoyo Rural Chuyma Aru, Puno. <http://www.pratecnet.org/pdfs/Crianza%20mutua.pdf>

GUNDY, B. J. 2008. Presumptive blood testing blind study. Appendix E in: Gundy, B. J., Mohny, K. W., Espenshade, C. T., A. T. Vish, and M. G. Sams 2008 New Castle County, Delaware, Brandywine Hundred, Blue Ball Area Transportation Improvements: A Few Hours in the Piedmont: Archaeological Investigations of Site 7NC-B-54 (Ronald McDonald 307House). Report prepared for the State of Delaware Department of Transportation, submitted by Skelly and Loy, Inc. [http://www.bluestar-forensic.com/pdf/en/bluestar\\_archeology\\_presumptive\\_blind\\_test.pdf](http://www.bluestar-forensic.com/pdf/en/bluestar_archeology_presumptive_blind_test.pdf)  
Accessed: February 2018.

HOGG, A., HUA, Q., BLACKWELL, P., NIU, M., BUCK, C., GUILDERSON, T., HEATON, T., PALMER, J., REIMER, P., REIMER, R., TURNEY, C. ZIMMERMAN, S. (2013). SHCal13 Southern Hemisphere Calibration, 0–50,000 Years cal BP. *Radiocarbon* 55 (4).

DOI:10.2458/azu\_js\_rc.55.16783. <https://journals.uair.arizona.edu/index.php/radiocarbon/article/view/16783>

LECOQ, P. y S. F. FIDEL. 2000. Algunos aspectos de la vida y de los ritos ganaderos en Ventilla, una comunidad pastoril del Sud de Potosí, Bolivia. En: *Pastoreo Altoandino. Realidad, sacralidad y posibilidades*, J. A. Flores Ochoa y Y. Kobayashi (eds.), pp. 150-183. Plural Editores y Museo Nacional de Etnografía y Folklore, La Paz, Bolivia.

LÓPEZ CAMPENY, S. M. L. 2014. The agency of textile technology in some archaeological ritual contexts of Northwest Argentina. *Journal of Anthropology and Archaeology*, Vol. 2 (2): 39-75. DOI: 10.15640/jaa.v2n2a3 <http://dx.doi.org/10.15640/jaa.v2n2a3>

LÓPEZ CAMPENY, S. M. L.; Babot, M. P.; Romano, A. S.; Galván, V; Castellano, G. E. y Moreno, E. 2015. Quínoa y kustal... Evidencias arqueológicas de la participación de la quinua en rituales andinos de producción. Libro de Resúmenes del V Congreso Mundial de Quinoa y II Simposio Internacional de Granos Andinos, p.203, San Salvador de Jujuy, Argentina.

MURGÍA SÁNCHEZ, L. 2000. El espacio sagrado de los pastores aymaras. En: *Pastoreo Altoandino. Realidad, sacralidad y posibilidades*, J. A. Flores Ochoa y Y. Kobayashi (eds.), pp. 201-211. Plural Editores y Museo Nacional de Etnografía y Folklore, La Paz, Bolivia.

SPALDING R. P. 2006. The identification and characterization of blood and bloodstains. In: *Forensic science: an introduction to scientific and investigative techniques*, James S.H. and Nordby J.J. (eds.), pp. 237–260, 2nd edn. CRC Press, Boca Raton, FL.

WEBB, S. K. 2006. Luminol vs. BlueStar® Forensic: A Comparison Study of Latent Blood Reagents. In: [http://www.bluestar-forensic.com/pdf/en/St\\_Louis\\_comparison\\_study.pdf](http://www.bluestar-forensic.com/pdf/en/St_Louis_comparison_study.pdf) Accessed: February 2018.

WINKEL, T.; MANIFIESTO, M.; LÓPEZ CAMPENY, S. M. L.; JOFFRE, R.; HOCSMAN, S.; COSTA TÁRTARA, S.; BERTERO, H. D.; BABOT, M. P.; ASCHERO, C. A.; ARIZIO, C. y AGUIRRE, M. G. 2015. La quinua y sus prácticas en la cuenca de Antofagasta de la Sierra: continuidades y cambios propuestos por los estudios de diversidad genética (ca. 1500 AP al presente). E-book Avances en el estudio de la transición a la producción de alimentos en Antofagasta de la Sierra; editado por: González Baroni, L.; F. Bobillo, G. Aguirre, S. Hocsman y G. Spadoni, p. 70-71, EDUNT, San Miguel de Tucumán, Argentina.