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Amaranthus hybridus L. ssp. *hybridus* in an archaeological site from the initial mid-Holocene in the Southern Argentinian Puna

Guillermo A. Arreguez [a,*], Jorge G. Martínez [b], Graciela Ponessa [c]

[a] Fac. de Ciencias Naturales e Instituto Miguel Lillo-UNT, Miguel Lillo 205, 4000 San Miguel de Tucumán, Tucumán, Argentina
[b] ISES-CONICET/Instituto de Arqueología y Museo-UNT, Argentina
[c] Instituto de Morfología Vegetal, Fundación Miguel Lillo, Argentina

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ABSTRACT

The main objective is to present the discovery of a wild species of the *Amaranthus* genus found within an archaeological site whose general context corresponds with hunter–gatherer settlements dated between *ca.* 7910 and 7270 BP. Numerous seeds were collected at various stratigraphic layers of Peñas de la Cruz 1.1 site (PCz1.1), a rockshelter located in the Southern Argentinian Puna, in Antofagasta de la Sierra (Catamarca, NW Argentina). The implications of the findings are assessed in relation to the subsistence for these groups traditionally known as camelid hunters. In the overall context of the South-central Andes, the presence of these seeds might indicate early practices in the handling of wild plant species intended for human consumption during the initial mid-Holocene.

1. Introduction

The Puna's characteristic arid conditions have played a fundamental role in preserving all types of organic remains up to the present. However, plant macro-remains suitable for human consumption that are found in this eco-region are very scarce for the early and mid-Holocene.

In the area of study, as well as in all other areas in the Argentinian Puna for this period, the parameters affecting the subsistence of human groups have been focused mainly on the zooarchaeological evidence (Yacobaccio, 1991; Elkin, 1996; Mondini and Elkin, 2006). This bias towards the study of animal resources is directly related to an almost non-existent record and/or to the absence of vegetation traces within the same contexts. Consequently, the subsistence of these groups has been shaped by the strong prevailing influence of the hunter mode rather than the gatherer mode.

On the matter of human subsistence, it is well known that a slightly balanced diet cannot be based exclusively on meat intake. Plant resources have always been necessary to supplement and give nutritional balance to dietary habits.

Up to the present, the largest information *corpus* about plant use and consumption by early hunter–gatherer groups in the Southern Argentinian Puna has resulted from studies done on micro-remains. Microscopic indicators consist of plant micro-fossils recovered from grinding artifacts, and research seeks to explore the different paths the uses of plant resources have taken since *ca.* 6500 BP (Babot, 2006, 2008, 2009). This search is an attempt to bridge the information gap on plant use during the early and mid-Holocene among non food-producing groups.

In this sense, the discovery of wild amaranth in the site Peñas de Cruz 1.1, broadens the spectrum and indicates that both these seeds as well as other parts of the plant were consumed by these early "hunters". Amaranth was a very important nutritional and feeding source for the groups inhabiting the South American territory in pre-Hispanic times (Chagaray, 2005). The purpose of this study is to contribute information that will lead to a better understanding of the role plant foods played in the Argentinian Puna during the mid-Holocene.

2. General context of the discovery

There is no evidence of vegetable foods in archaeological sites in either the Argentine Northwestern region (NOA) or in the South-central Andes before 7000 BP. In the case of amaranth, in the region of Antofagasta de la Sierra specifically, it is only towards *ca.* 4500 BP that micro-remains are registered, though in its domesticated variant (*Amaranthus caudatus*; Babot, in press). The absence of amaranth (and/or quinoa) macro-remains in early sites in Antofagasta de la Sierra might have been the result of

* Corresponding author.
E-mail addresses: puchiarreguez@hotmail.com (G.A. Arreguez), jormartin1969@yahoo.com.ar (J.G. Martínez), ponessagra@gmail.com (G. Ponessa).

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methodological aspects connected with the detection and recovery of these types of pseudo-cereals, which could have originated in the fact that their reduced size (under 1 mm) may have been an obstacle for their proper detection.

On the other hand, it is of paramount importance to mention that, traditionally, the hunter–gatherer subsistence mode was defined mainly by the consumption of camelids, leaving aside issues regarding gathering practices for subsistence. Until now, the presumption that there were both gathering and consumption of wild plants among early groups was not backed by any material evidence. Below follows a brief description of the particular context in which the plant remains were discovered in PCz1.1.

Antofagasta de la Sierra is located within the Salt Puna (*sensu* Troll, 1958) which is typically very arid (less than 100 mm/year) and has the lowest net primary productivity in the entire Puna (Fig. 1). The discovery of Peñas de la Cruz 1.1 site, located at 3665 m asl (see Figs. 2 and 3), was the result of prospecting jobs carried out in 1998 in the mid-basin of the Ilanco River, which expanded the database on sites belonging to the early and mid-Holocene. PCz1.1 is one of the five sites within Antofagasta de la Sierra with a date range between *ca.* 10,200 and 7000 BP. As for subsistence, zooarchaeological studies reveal that this period was primarily based on hunting and consumption of wild camelids (especially *Vicugna vicugna*; Elkin, 1996; Reigadas, 2006, 2008; Mondini and Reigadas,

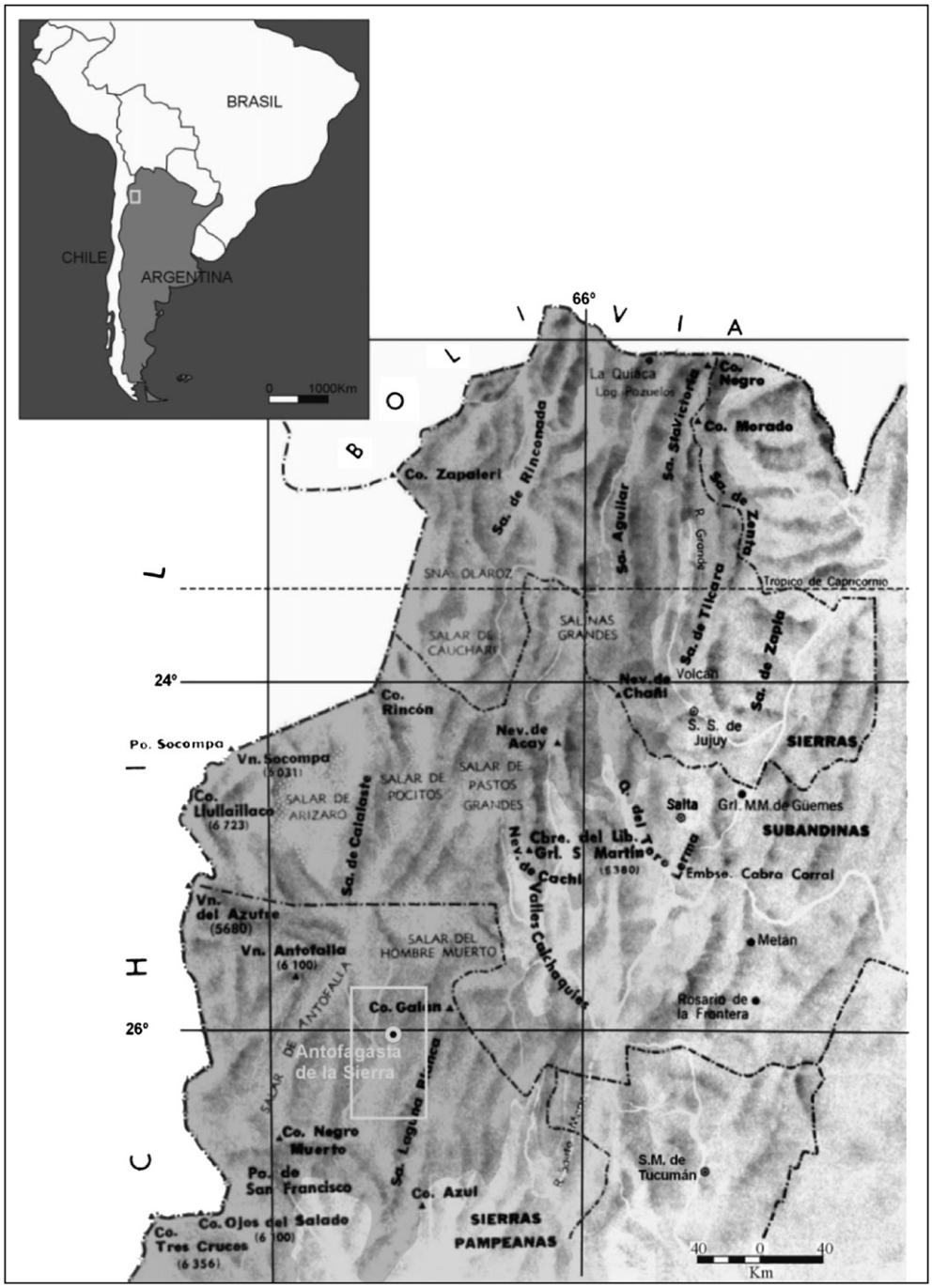

Fig. 1. Geographic location of the study area.

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Fig. 2. General view of the Peñas de la Cruz site.

2007). Previously, for the same time range, there had been no records of any plant food-type in the study area mentioned.

The excavations in PCz1.1 resulted in a stratigraphic sequence made up of four anthropic layers, which make up a stratigraphic "package" 0.50 m thick. Layer 2 was the most relevant one due to the amount and variety of archaeological remains recovered within a matrix composed of five sub-layers of bundles of grass (*Deyeuxia deserticola* and *Juncus arcticus*; Martínez, 2005). Among these were stone tools ($N = 48$), high density of stone flakes, shafts and foreshafts of wood ($N = 9$), bone retouchers ($N = 18$), strings of plant and animal fibers, valve beads, high density of wild bone camelid remains, leather and insect remains (Martínez, 2005). All archaeobotanical macro-remains analyzed in this study come from layer 2.

3. Sampling: macro and microscopic analysis

The lab work carried out for the taxonomic identification of botanical macro-remains was divided into three stages: 1) Detection and separation of plant specimens; 2) Macroscopic description of samples; and 3) Microscopic description. Macro-remains analyzed were detected during the laboratory stage and not during the excavation phase. During excavation of PCz1.1, a high density of debitage was recorded, so all the material from the *decapage* was collected in order to separate the materials in the laboratory afterwards. The emphasis given to this division (done manually and macro-visually) focused on recovering the largest amount possible of stone flakes for the study of stone tool manufacturing at this site (Funes Coronel, 2009). It was thanks to this meticulous process that the minute seeds (smaller than 1 mm) were found collaterally, mixed with stone material, as well as with bone remains, fleece, feathers and fine sandy sediment.

Although the specimens were found throughout the five extractions of layer 2, for the purpose of this study, only those recovered in layer 2 (3rd extraction) were considered due to the fact that it held the largest amount of remains in relation to other extractions. The total number recovered was 112 specimens, of which three were chosen for description and subsequent identification. Their macroscopic description was done considering external qualitative and quantitative features (longitude, latitude, colour, shape). The maximum length and width samples were measured with a regulated calibre in millimetre decimals and with back-surface millimetre-scaled sheets for photographic records. The specimens measure 0.5 and 0.7 mm in diameter, are black, have a smooth shiny surface, and have a dorsiventral biconvex symmetry (Fig. 4a and b).

As regards internal features, a micro-morphological description was done of the archaeological seeds by means of longitudinal and transversal cuts. For sample preparation, following D'Ambrogio de Argüeso (1986), a diaphanisation process was carried out to achieve transparency in the material. The samples were put into 10% potassium hydroxide to clean cellular content, they were then washed with distilled water, and left to rest for five days. Subsequently, a colouring substance was selected, the samples were dyed and, afterwards, the assembling of the samples was done with glycerine water and enamel (to seal) so as to proceed with microscope observation. For the latter, an anatomic analysis was carried out using an optical microscope (Zeiss Axiolab) at different magnification levels, as well as a binocular magnifying glass (Olympus). For a more clear-cut identification, current reference materials of the different species within the *Amaranthus* gender were used given the similarities they bear in size and colour with preliminary archaeological cases. Specific research was also consulted (Burkart, 1952; D'Ambrogio de Argüeso, 1986). The cuts showed that in every case three well-defined parts were present: episperm or seminal cover, embryo and perisperm, as well as endosperm remains (Fig. 5). The episperm showed three different layers: an external one made up of elongated cells and straight walls; a second one, thin and smooth without perceivable cellular formations; and a third one of an opaque color and globe-like shape. The embryo consists of two cotyledons and a radicle, and it encloses the perisperm in a horseshoe shape. The perisperm is whitish, has large polygonal cells with straight thin walls and represents most of the seed's surface (60% approx.). The current reference samples used were collected in 2009 in the province of Catamarca, Ambato department, in the locality of La Puerta at ~900 m asl (Figs. 6 and 7).

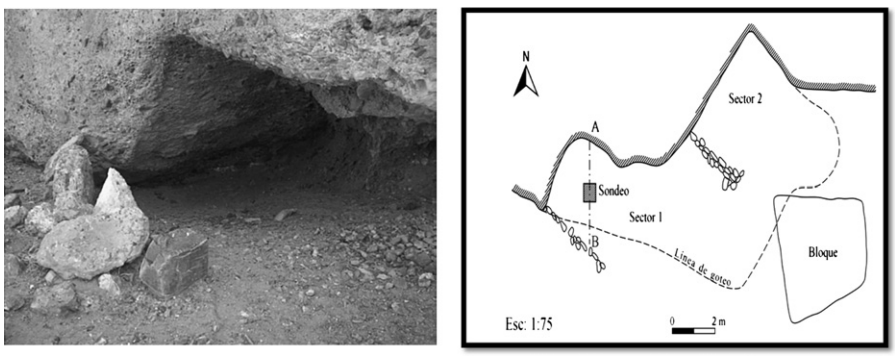

Fig. 3. Peñas de la Cruz 1.1: details of the excavated sector.

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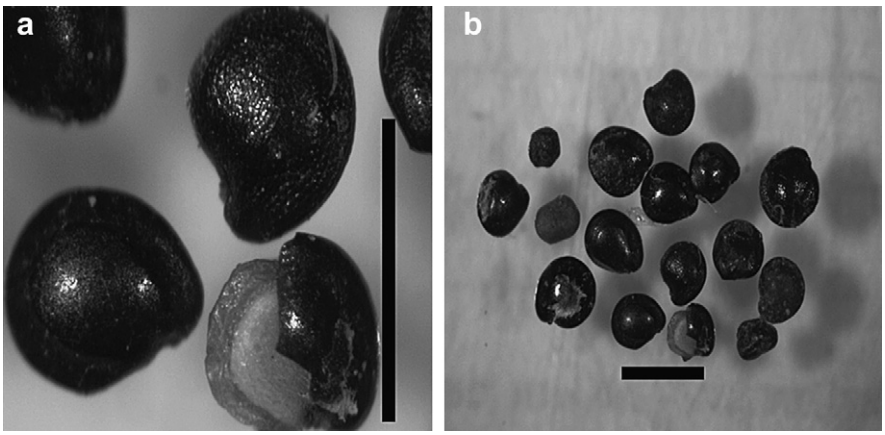

Fig. 4. a and b. Archaeological samples from the PCz1.1 site (scale bar 1 mm).

4. Results and discussion

The result of this process of analysis determined that the archaeological specimens belong to *Amaranthus hybridus* L. ssp. *hybridus* (Amaranthaceae), also known as *A. hybridus* L. var. *quitensis*, commonly called "ataco" or "yuyo colorado" (red weed).

There are records of multiple ways of preparing wild and domesticated amaranth for human consumption, and it is known for its high nutritional level as a food source (Figueroa and Lackner, 2002; Peralta, 2009). Its presence in the archaeological context of PCz1.1 is a result of its having been consumed by those who occupied the site during the initial mid-Holocene. As mentioned, there were no records of these wild seeds in other synchronous sites of Antofagasta de la Sierra, and they represent the first find of this type of macro-remains for the early stages of the NOA region. Interesting questions ensue about its dietary role and, in terms of subsistence strategies, it highlights vegetation gathering within the hunter–gatherer spectrum. Although there is only one present-day record of "ataco" towards the north of the Antofagasta de la Sierra basin (in Paicuqui; Olivera, 2006), this plant is not currently part of the natural flora of the study area. The natural altitudinal range for the species' growth is estimated at up to 2400 m asl (Zuloaga and Morrone, 1999), which would imply it was a non-local resource that came from remote pre-Puna areas. Because this species is adapted to grow in arid environments, and had not been recorded in the study area (Rodríguez, 1998; Cuello, 2006), it is highly unlikely that it may have been part of the natural flora in the past. Further pollen studies will addresses this issue for the period under study.

Peñas de la Cruz 1.1 has been pinpointed as a logistic campsite aimed at: providing stone resource supplies and/or base-forms; the making and maintenance of hunting weapon systems; and the consumption of animal resources (Martínez, 2005). The presence of *A. hybridus* L. ssp. *hybridus* seeds at this site allows consideration of the potential consumption of all and/or parts of this wild plant (leaves), as a vegetal complement for these early human groups, thus widening their staple subsistence diets, which up to the present were only possible to characterize as based on animal resource consumption. Ongoing micro-remains analysis (P. Babot) of passive and active grinding artifacts associated with a *ca.* 7040 BP date (sector 1.2 in this site) will complement this information and define its possible links in terms of processing. On the other hand, in addition to specimens of amaranth, three other types of food seeds were recovered in PCz1.1, which are still being analyzed. One is a

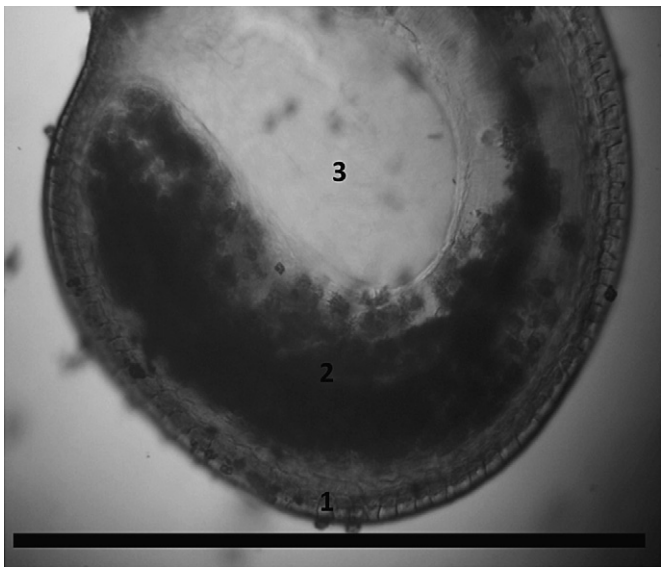

Fig. 5. Archaeological sample and its parts: 1 – episperm, 2 – embryo, 3 – perisperm (scale bar 0.5 mm).

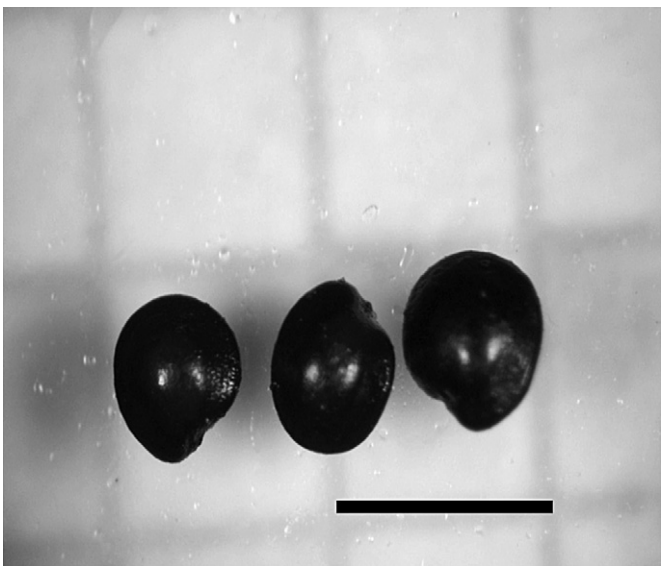

Fig. 6. Samples of current *Amaranthus quitensis* picked in Catamarca (scale bar 1 mm).

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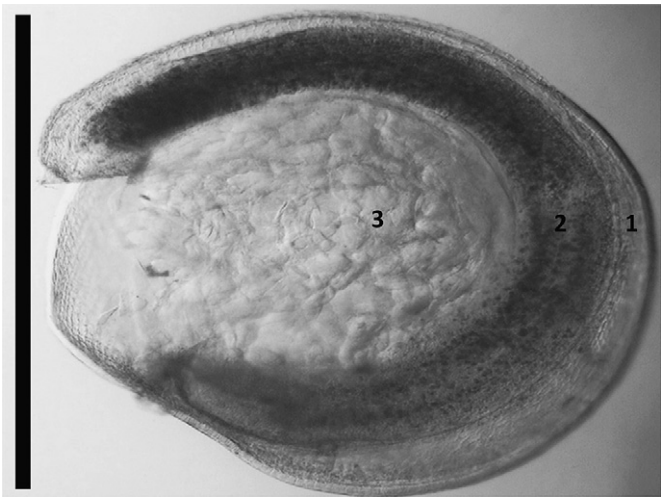

Fig. 7. Sample of current *Amaranthus quitensis*. 1 – episperm, 2 – embryo, 3 – perisperm (scale bar 0.5 mm).

fabaceae, another is a solanacea (D. Bertero–B. Galati, personal communication 2011), and the third one is a cactaceae akin to *Opuntia* sp. (N. Muruaga, personal communication 2011). What remains to be answered is whether these species relate to an expansion strategy of food resource base, which could have been the case given the arid growing conditions recorded at a macro-regional level at this moment of the initial mid-Holocene. Subsequent findings in other synchronous sites of the area would provide a better basis on which to assess such issues and, in turn, will improve the methodological aspects connected to the recovery of this kind of small remains.

To sum up, this study hopes to contribute to the ongoing debate related to the initial handling practices of wild plant species intended for human intake. These types of practices were certainly the starting point of the complex process that thousands of years later would lead to great socio-economic changes associated with the establishment of agriculture proper.

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