Open Archaeology 2018; 4: 394–405 DE GRUYTER

Original Study

Alberto E. Pérez*, Verónica Schuster, Daniella Jofré P.

Amphibiomorphic Modeled and Painted Pottery from Argentine Patagonia and Central-Southern Chile. Functional Interpretation and Identification of Species Based on Mimetic and Aposematic Traits

https://doi.org/10.1515/opar-2018-0026
Received June 28, 2018; accepted October 8, 2018

Abstract: This work aims to identify attributes or features related to endemic amphibians in modeled and painted pottery from central-southern Chile and north-western Argentina. From this work, we were able to identify four species of amphibians represented in certain types of modeled and painted pottery, and we also complemented this data with modern references and ethnohistorical chronicles of the potential use given to this pottery in particular. This contribution postulates that some elements of the black-on-red pottery of the Early Ceramic Period of Araucanía in central-southern Chile and of Patagonia in north-western Argentina, seek to highlight amphibiomorphic characteristics such as exophthalmia (protruding eyes) and aposematism (brilliant coloring and brightness of the vessel by using an engobe decoration). Based on the ethnohistorical data of the area, it is also proposed that these vessels could be linked to the exclusive use of highly toxic substances. Finally, the results allowed us to explore the close ecological interaction between human groups and woodlands.

Keywords: archaeological pottery, Patagonia, Araucanía, amphibians, toxic substances

1 Introduction

The Pitrén Complex has been defined as the first horticultural occupation of the central-southern region of Chile, whose occupation range extended from the Bío-Bío River to Lake Llanquihue, as well as towards the center and north of the Neuquén province in Argentina (Aldunate, 1989; Adán et al., 2016).

The antiquity of this pottery complex could go back to approximately 2,000 years BP from the new dating of the Flor del Lago 1 site, remaining in marginal areas such as islands (Quiróz & Sánchez, 2005) or mountain lakes (Reyes, Sanhueza, & Adán, 2003–2004) – to the years 1,200–1,400 AD. In the mountainous sector, this type of pottery is associated with other unique aspects such as expeditive and preformative lithic technology for the maintenance of instruments and preserved in extractive instruments (Pérez, 2016), along with typical wildlife of the forest and lake. This human occupation was supported with a diet

***Corresponding author: Alberto E. Pérez,** Departamento de Antropología, Universidad Católica de Temuco, Manuel Montt #56, Temuco, Casilla 15D. Región de La Araucanía, Chile, E-mail: aperez@uct.cl
Verónica Schuster, IDEAUS. Centro Nacional Patagónico (CENPAT - CONICET). Boulevard Brown #2015 (9120). Puerto Madryn, Chubut, Argentina
Daniella Jofré P., Departamento de Antropología, Universidad Católica de Temuco, Manuel Montt #56, Temuco, Casilla 15D. Región de La Araucanía, Chile

centered on vegetable harvesting, complemented with hunting and horticulture based on tree logging and forest clearing (Velázquez & Adán, 2002; Adán, García, & Mera, 2010; Adán & Mera, 2011). Recently, fishing practices have also been identified in the area (Pérez, Schuster, & Castiñeira, 2017). Similarly, it is described as an Andean expression of the Archaeological Tradition of Temperate Woodlands, based on sites of the Western mountain range (Adán, Becerra, & Godoy, 2004).

In principle, the Pitrén Complex was characterized by its pottery context (Aldunate, 1989), then by its funerary pattern (Dillehay, 1990), and currently defined and determined based on its settlement pattern, the organization of its technology and subsistence, which is considered to be a forest and lacustrine adaptive strategy (Adán, García, & Mera, 2010; Adán & Mera, 2011; Navarro Harris, Dillehay & Adán, 2011). With a mixed economy and use of pottery, this society would have been composed of small family groups that used a hunter-gatherer-fisherman-horticultural subsistence system and seasonal residential mobility. They were predominantly located on lake shores, river banks and in lakeside foothill areas (Aldunate, 1989; Dillehay, 1990; Castro & Adán, 2001). It should be noted that a more conservative and longer-lasting Eastern archaeological counterpart – on the coast or in the central depression of Chile (Aldunate, 1989; Adán & Alvarado, 1999) – has also been proposed and that the Lácar basin from Argentina was recently added into the "Eastern mountainous sector" in the archaeological area of the Valdivia River Basin (Pérez, 2016), which is binationally-shared.

The Pitrén Complex (Menghin, 1962) has been shaped by a series of pottery types that were recognized by pioneer studies in the 1960s in the central-south area of Chile (Menghin, 1962; Berdichewsky & Calvo, 1972–1973), which were later resumed by contemporary researchers who systematized and redefined them giving rise to new decorative and morphological typologies (Aldunate, 1989; Adán & Mera, 1997; Adán & Alvarado, 1999; Adán et al., 2016). An important part of the decorative elements that would characterize the tradition of this complex ceramic is resistant paint (Aldunate, 1989; Adán & Mera, 1997; 2011; Adán, Reyes & Mera, 2001) and the use of black and red colors, used almost exclusively on the jar morphological category (Adán & Alvarado, 1999). Regarding the reasons and configuration of this decoration, some specific decorative typologies clarifying several varieties of designs and sharing the same geometric elements have been established (Adán & Mera, 1997).

It has previously been hypothesed that an exclusive use of certain type of vessels to produce and contain toxic substances (Pérez, 2011; Pérez, Reyes, & Hermann, 2012). These containers could present external attributes to enhance the social value or ritual importance of its contents as well as avoid its involuntary or accidental consumption of the toxic substances which they contained. Following this proposal, this work suggests certain modeled and painted attributes are not only decorative features, but markers or signs of alert that distinguish these vessels containing toxins or poison from the ones commonly used in utilitary or domestic activities. If we consider ethnographic sources and the ethno-ecological characteristics of endemic amphibians of the region, some of these vessels such as the amphibian modeled ones and the bichromatic designs in black over red engobe could be linked to the production and exclusive use of toxic substances.

Within the variability of modeled and painted amphibiomorphic vessel design, both naturalistic and abstract, certain features or attributes allow amphibians' species identification, including etho-ecological aspects and their functional implications, contributing to further understand the interaction of human groups with woodland environments and resources in the Araucanía of central-southern Chile and the Patagonia of northwestern Argentina.

2 Materials and Methods

For this work, we have considered ceramic materials from the Pitrén Complex of Chile and Argentina as published by various authors (Adán & Alvarado, 1999; Adán & Mera, 1997; Adán et al., 2016; Aldunate, 1989; Dillehay, 1990). These come from the collections of the Museo Regional de La Araucanía (Temuco, Chile), Museo Arqueológico de Valdivia (Isla Teja, Valdivia, Chile), Museo Chileno de Arte Precolombino (Santiago, Chile), and the Museo Francisco Pascasio Moreno, Río Negro (Argentina). We also considered ceramic materials recovered from excavations at the Villa JMC-01 Labranza archaeological site (Mera & Lobos, 2008) and of various funerary sites from the archaeological area known as By-Pass Temuco (Ocampo,

Mera & Rivas, 2001), both in Chile, to which we added collections from our own excavations in the Lake Meliquina archaeological area, Argentina, in the Eastern slope of the Cordillera (Pérez, 2011, 2016).

The methodology consisted in the bibliographic and geographic review of the study area, including the eto-ecological habits of diverse species of endemic amphibians (Formas, 1979; 1995; Formas, Núñez, & Brieva, 2001; Veloso, Núñez, Úbeda, Lavilla, & Blotto, 2004; Rabanal & Núñez, 2008). We also reviewed specific bibliography defining the Pitrén pottery in this area in particular, specifically decorated with modeled features or using negative black paint over red engobe (Adán & Alvarado, 1999; Adán & Mera, 1997, 2011; Adán et al., 2016; Mera & Lobos, 2008).

Using information available from the species of amphibians currently present in the region, as well as the photographic and bibliographic material of the Pitrén modeled and painted pottery, potential features key to identifying particular species of amphibians were hence evaluated.

2.1 Elements for the Interpretation of Amphibiomorphic Modeled Design and Black Paint over Red Engobe Decoration Modality

Here we synthetize the main characteristics of the Pitrén ceramic group and also propose some diagnostic amphibian species represented by modeled or painted attributes in this type of pottery. It is worth noting that these ceramic types currently appear in the same habitat of the amphibian species that we mention, despite landscape and climate changes over the last two millennia. This subject, and its implications, are developed during the final considerations of this work.

In a characterization study of the pottery sets in the central-southern area of Chile, Adán & Alvarado (1999) analyzed a total of 344 complete pieces, among which they distinguished three decorative modalities: negative technique, modeling and engraving. Of these pieces, 22 (6.4%) presented decoration by using a negative technique of black-on-red. They argued most of the drawings would have been obtained by the application of a "temporary protective material", which allows for the covering certain areas to preserve the original color of the vessel or engobe when subject to "smoking" (Castro & Varela, 1990; Pérez & Reyes Álvarez, 2009; Pérez, Reyes, & Hermann, 2012; Barrientos Romero, 2013) (Figure 1).

Figure 1. Example of morphological group 15, "jars" category (Adán & Alvarado, 1999, p. 258, Fig. 1) from the Museum of Valdivia, Chile (N° A0514); courtesy of Verónica Reyes Álvarez.

This type of decoration appears to be associated solely with the "jar" category types 1, 2, 7, 8 and 15 as proposed by Adán and Alvarado (1999, p. 257), who also postulate from an aesthetic point of view that "*...it is privileging a type of artefact to which it is desired to give a distinct and singular appearance*". According to the authors, these vessels appear in less proportion in contexts in which monochrome types are the majority – increasing the monochrome modeled decoration and appearing with the red-black bichrome decoration in negative technique in its "Starred" -or C- and "Crossed" -or D- varieties (Adán & Alvarado, 1999, p. 260). Also, they estimated their ages between 750±100 years AP (UCTL-885) – from the Los Lagos site – and 1,255±180 years AP (UCTL-884) in the La Tereña site (Adán & Alvarado, 1999). Recently, the known range for the bichrome Pitrén black paint over red engobe vessels expanded after its identification to the south of the Neuquén province, specifically in the sites of Montículo Angostura (900±75 BP), Arroyo la Dulce (TL 980 BC), Cueva Haichol (695±70 BP) (Hajduk, Albornos, & Lezcano, 2013), and in the archaeological localities of Meliquina Lake and Lácar Lake (Pérez, 2010a; Pérez, 2016). Its presence has also been found during at least the last 1.400 years BP in the Woodland área of the locality of El Manzo, north of the Chubut province in Argentina (Bellelli, Carballido, & Stern, 2018).

Regarding the amphibiomorphic figurative type "stylized" in asymmetric jars (variety "E" according to Adán & Alvarado, 1999; or group "ñ" according to Adán et al., 2016, Fig. 3), it is said that:

> *Six pieces of type 15 correspond to this variety; they are presented in bichromatic vessels with a design arranged in a cross. On the opposite side of the neck, a three-dimensional hollow is formed, sub-cylindrical at the lower end and pointed at the upper end, presenting an ellipsoidal section. The handle is attached to it, immediately under the extremity in which an incision is made, giving rise to the "mouth" feature. Usually, below this last detail and towards the body is a slight bulge like a double chin* (Adán & Alvarado, 1999, p. 255).

Mera and Lobos (2008) call this attribute the "big mouth feature", a characteristic of amphibians (toads and frogs) that allows them to capture flying insects or aquatic prey. Based on this feature, reference has been made only to the Chilean frog *Caudiverbera Caudiverbera* (Linnaeus, 1758) since it has a head that measures one third of its total length. However, large mouths are a common frog and toad feature and little analysis has been undertaken of other species present, several of them endemics to the south central area of Chile. In addition to its endemic nature, the southern batrachofauna is notable for having very few species in relation to the tropical forests of South America. Here there are leptodactylids of the genus Caudiverbera (monotypic), Telmatobufo (three species), Insuetophrynus (monotypic), Batrachyla (three species), Hylorina (monotypic), Alsodes (one species), Eupsophus (three species) and Pleurodema (one species). There are also buffoids of the genus Bufo (three species) and rhinodermatids of the genus Rhinoderma (two species) (Formas, 1979, 1995). As we will see later, some of these species can be identified by certain modeled and painted attributes, and after describing them we will focus on discussing some characteristics about the species *Telmatobufo venustus*, since it has a specific distribution and external characters that have led it to be linked to a particular morphological group of vessels in our study (Figure 2).

The anurans have strong adaptations to the temperate forest environment of southern Chile, which are manifested especially in reproduction (Formas, 1979, 1995; Rabanal & Núñez, 2008). Altitudinally, toads and frogs reach up to 1000 m.a.s.l; however, a few species (*Bufo variegatus*, *Bufo chilensis* and *Pleurodema thaul*) can exceed 2000 m.a.s.l. It is also possible that in this case temperature is the factor that influences this distributional pattern. Most of these species live in the wooded soil; but some are conditioned to aquatic environments. *Caudiverbera caudiverbera* is adapted to waters of the lentic type but *Insuetophrynus acarpicus* and the species of *Telmatobufo venustus* and *Telmatobufo australis* live in bodies of water of the lotic type found both within the forest and in its periphery (Formas, 1979).

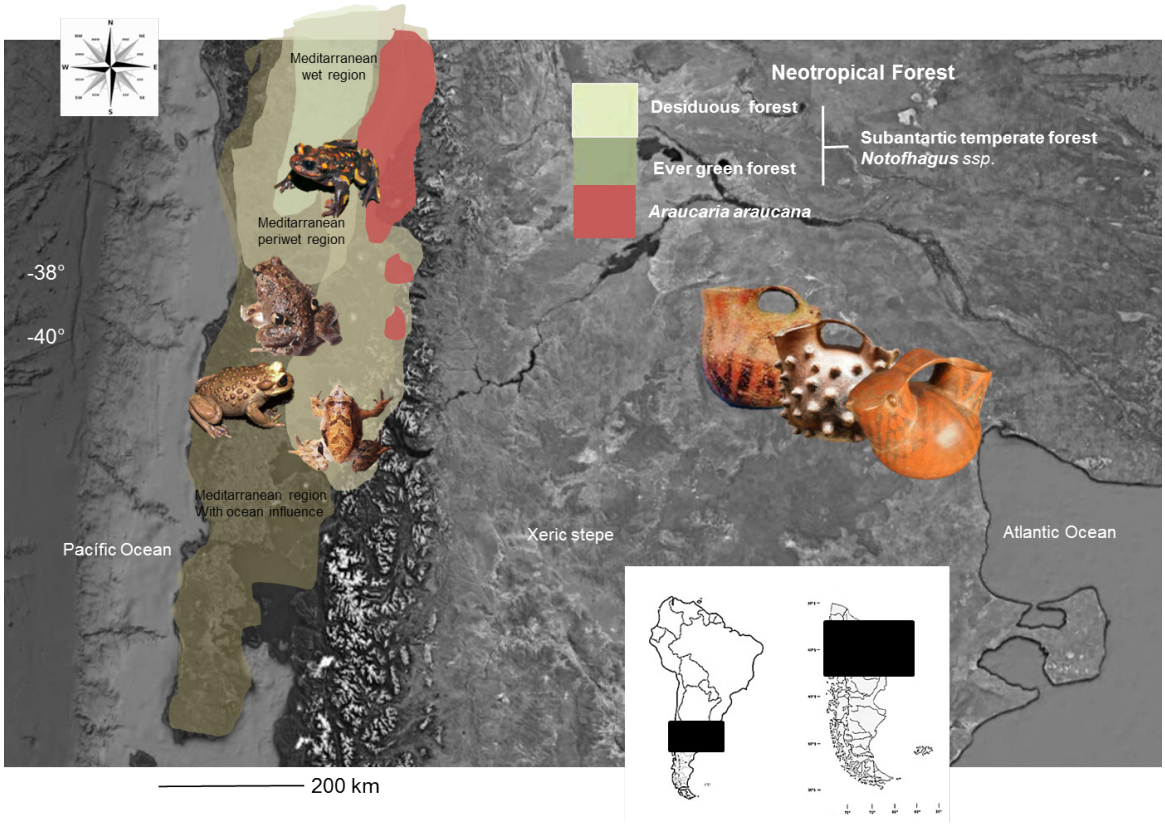

Figure 2. Habitat of species represented and distribution of black over red pottery.

3 Results

3.1 Species Identification of Amphibians According to Attributes or Features in Pottery

Until now, amphibian representation in the ceramic registry of central-southern Chile has been analyzed in generic and mono-specific terms; its identification has not determined species. Nevertheless, certain decorative features from Pitrén vessels, both modeled and painted, are taxonomically diagnostic and allow linkage with endemic amphibian species that present ethno-ecological aspects of archaeological interest. Based on modeled and/or painted features and attributes of this ceramic type, four possible species of amphibians were identified:

Telmatobufo venustus (Philippi, 1899) are distributed in temperate forests of Nothofagus in central-southern Chile (35° 30'–41° 10' S) from sea level to 1,280 meters above sea level, that is, in the Chilean coastal range and Andes foothills (Formas, Núñez, & Brieva, 2001). Vessels with singular characteristics compatible with this species display bright and brilliant colors, mainly black and red, and sometimes orange and yellow, distributed in linear bands and dots. The similarity with the black over red vessels becomes evident from the species holotype as illustrated by Phillipi (1899, Figure 3 and 4-A).

Telmatobufo bulloki (Schmidt, 1952), it has a limited distribution to the Humid Mediterranean Region of the Nahuelbuta or Chilean Coastal Range (37° 05'–38' S). Altitudinally it can be located between 10 m and above 800 meters above sea level. This particular species is usually found in the fallen trunks of *Araucaria araucana* and in streams from August to November (Formas, Núñez, & Brieva, 2001). To date, vessels with this representation have been interpreted as a generic species of amphibian (any species) and its multiple modeled glands considered an exaltation of the representation of palmar appendixes as a metaphor of fertility (Mera & Lobos, 2008). However, other works have attributed these modeled appendixes as a graphic representation on an amphibian laying eggs (Araya et al., 2011) (Figure 4-B).

Figure 3. Right: Representation of morphological group 15, "jars". Left: Front and back illustration of the holotype for *Telmatobufo venustus* by Phillipi (1899), published in Formas, Núñez and Brieva (2001, p. 375, Figure 5), with its characteristic aposematic color (red on black).

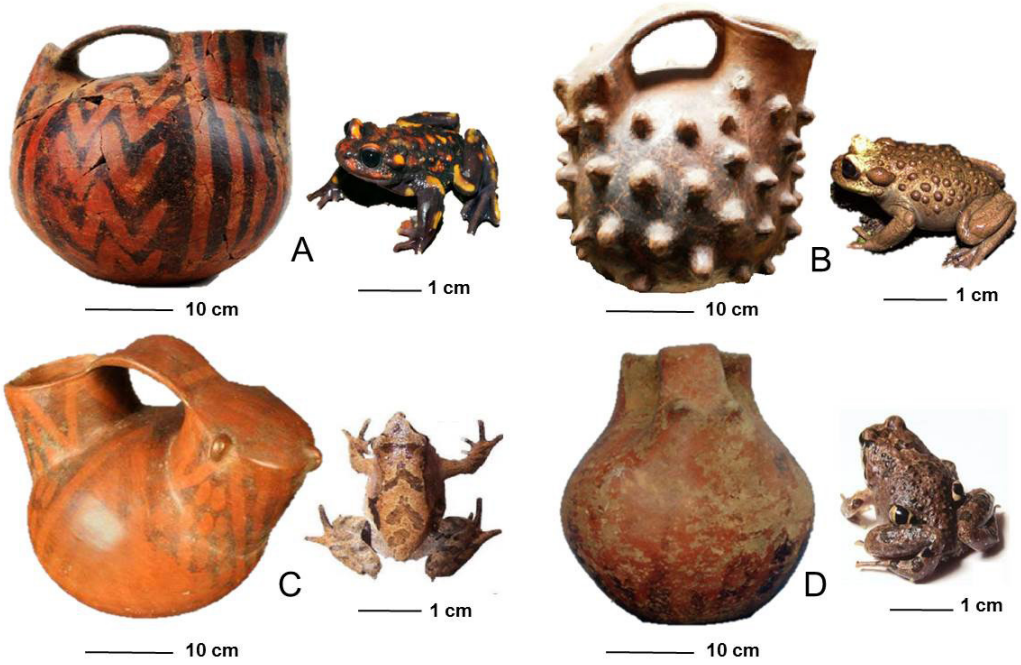

Figure 4. Vessels representing amphibian species: A- *Telmatobufo venustos,* B- *Telmatobufo bullocki*, C- *Rinhoderma darwinii*, D- *Pleuroderma thaul.*

Rhinoderma darwinii (Duméril & Bibron, 1841) is generally characterized by a nasal prolongation and a small size. Its preferred habitat is cool and temperate rainforest (Valdivian forest). The males carry their offspring in their vocal pouch until the completion of their metamorphosis. Darwin's frogs are preyed on by visual predators such as birds (Rhynocryptidae) and snakes (Philodryas). A vessel representing this species has commonly been classified as an ornitomorphic representation known as *ketro-metawe* or "duck jar" as well as an abstract anthropomorphic representation (Dillehay & Gordon, 1979). However, the vessel illustrated in Figure 4-C displays multiple naturalistic characteristics that allow its identification as a modeled and painted representation of this species, also known as sapo vaquero (Formas, 1979).

Pleuroderma thaul (Lesson, 1827); in Chile, this particular species can be found from the Antofagasta to the Aysen regions, including Chiloé, from sea level to 2,100 meters above (Formas, 1979; Veloso et al., 2004). This species has adapted to anthropically disturbed environments and proliferates next to urban

areas (Rabanal & Núñez, 2009). This species is commonly known as “four-eyed” (Formas, 1979) because it has two appendixes that appear to be eyes towards the sides of its back, which is a defensive mechanism against predators.

The adscription of this species is based on various vessels that display bulbar appendixes in the extreme opposite to the mouth and would correspond to diagnostic features of genre (Figure 4-D).

3.2 Amphibiomorphous Representations in Central-Southern Chile

Rodrigo Mera and collaborators have recently characterized abundant ceramic materials from the Early Ceramic Period, which have been modeled into zoomorphic figures and in which naturalistic and abstract amphibomorphic variants are predominant (Mera & Lobos, 2008). The amphibiomorphic modeled vessels are recurrently attributed to representations of the “Ngenco”, “Newen Co”, or “water force”, (Pérez, 2010b). Mera and Lobos (2008) highlight amphibiomorphic attributes such as the modeled chin trait and the sexual calluses or appendixes applied by the technique of pastillage as symbols of fertility, reproduction and renewal of the life cycle of nature (Mera & Lobos, 2008). We could also relate to deeper cultural aspects of the amphibian figure in the worldview of the Reche and Mapuche peoples (Boccara, 1999), where they are described as creatures that move through burrows, connecting the earthly world or middle earth and the underworld where ancestors dwell (Faron, 1964; Dillehay, 1990).

The only amphibiomorphic modeled and painted vessel with negative or reserved technique and characterized to the species level comes from the funerary site of Villa JMC-01 Labranza which has been dated to 1,000 years BP (Figure 5). According to Mera and Lobos (2008), the vessel represents the spawning of a couple of the *Caudiverbera caudiverbera* species. We agree with the diagnostic modeled attributes of this species, which are syncretic to other aposematic amphibians from central-southern Chile.

Figure 5. Vessel from the JMC-01 Labraza archaeological site; image from Viviana Rivas, Fondart Project 21511-2. Courtesy of Doina Munita.

3.3 Preparation and Storage of Amphibian Toxines in Ceramic Containers

One of the ethnohistorically recognized characteristics of the Reche-Mapuche groups is the use of chemical substances of animal and plant origin (Aldunate, 1996), particularly the extraction of toxins and their processing to produce medicines, hallucinogenic substances and/or poisons.

There are abundant ethnographic registries about the extraction of toxins from toads and frogs in La Araucanía during the first half of the 20th century, where its ritual preparation is performed by specialists called “machis” using ceramic containers for processing and storing these toxins (Gusinde, 1917; Joseph, 1930; Hilger, 1945; Koessler-Ilg, 1963).

In Lácar’s watershed, Eastern slope of the Andes Cordillera, between the decades of 1920 and 1940, the ethnologist Bertha Koessler-Ilg recorded that the application of, or skin contact with, toads was used as an efficient anaesthetic for toothache in traditional Mapuche medicine (Koessler-Ilg, 2003). This suggests

the existence of active toxicological properties from some species of local amphibians. Regarding the production and use of lethal toxins in ceramic vessels there is a primary source, Martin Gusinde's account of 1917, about the preparation of posion in the region of Panguipulli using blood and corporal secretions of toads recovered from water courses. Gusinde (1917) narrates that, as part of the preparation, the toads' secretions amlong with vegetal components, were reduced in ceramic pots and transported in the same containers to the dwelling area.

Later on, Claude Joseph confirms the use of toxins from toads and frogs in poisons produced by machis using ceramic vessels (Joseph, 1930, p. 85). In 1945, another reference to this practice was made by Sister Inez Hilger in the bordering Panguipulli region (province of Valdivia, Chile), where she describes having witnessed a restricted production ceremony of the deadly *funapue* toxin, a process that literally translates as "beating toads" (Mera & Lobos, 2008). Hilger (1957, p. 158) states that this lethal venom – used in intra and intergroup vendettas and in war – was extracted from amphibian secretions (although it does not specify which species) and stirred into a ceramic vessel. This type of toxin was so deadly that fear of poisoning of *fanapue* determined the distance between the homes of inhabitants in the same community (Castro & Adán, 2001). According to members of the Mapuche community and information from anthropological researchers (Rosamel Millaman, personal communication, September 2018) from the Temuco region, the practice of making and poisoning with *fumapue* persists, having lethal intoxications both individual (intra-community) and collective (intra- and inter-community) during the last 50 years. However, this practice is kept secretly due to the fear it generates within Mapuche society.

3.4 Aposematic Characteristics of Amphibians

Following Mera and Lobos (2008), and considering a bigger corpus of ethnographic data as well as the etho-ecological aspects of amphibians endemic to the region, we propose that some amphibiomorphic vessels could have been used to prepare and store toxins. Hence, the modeled, painted, and reserved technical attributes in the exterior of the vessel would fulfill the function of exalting the symbolic and ritual value of its contents in order to 'mark' a warning signal to avoid involuntary intoxication (Pérez, 2011; Pérez, Reyes, & Hermann, 2012). The manipulation of toxins of vegetable and animal origin could generate the specialized use of pottery vessels, whereby some domestic utilitarian vessels containing toxins (medicines, hallucinogens or poisons) could be moved from a context of general use to a specific one (Pérez, 2011), from which it would henceforth have a distinguishing mark or sign thus preventing any member of the group from becoming poisoned. As a hypothesis, we argue, these manufactured vessels would have expressly contained products of high toxicity; amphibiomorphic vessels modeled with a large mouth feature (Mera & Lobos, 2008) as well as decorated with black paint over red engobe, both could be an example of intentionally visualizing the toxic and ritual value of the vessel contents.

Next we will explore the concept of aposematism and camouflage during the Early Ceramic Period which, we postulate, borrows from nature as a metaphorical warning signal to exalt and visualize the meaning (or symbolic value) of the contents in the vessels. Furthermore, this concept can be related to the interaction of human populations and woodland environments and resources in central-southern Araucanía, Chile, and north-western Patagonia, Argentina.

3.5 Camouflage and Aposematism

Within the modeled and painted species of our study area (Figure 4), external characteristics can be linked to avoiding predation by using diverse evolution strategies such as aposematic features used by the Telmatobufo species or displaying other adaptative strategies by using cryptic mimetic features such as the *Rinhoderma darwinni* in the woodland landscape. These amphibians can also display mixed strategies within their intra-specific variability.

Mimicry is defined as the property that some animals and plants have to relate and assimilate to other beings in their environment, either by camouflaging themselves against the landscape or by resembling other animals. The best known cases refer to visual mimicry, but there are also those of other senses

(Komárek, 1998). Mimicry should be differentiated with camouflage or "cripsis"; while the mimetic animal resembles another, the cryptic resembles its surroundings (Komárek, 1998; Summers & Clough, 2001; Santos, Coloma, & Cannatella, 2003).

In animals, mimicry frequently accompanies aposematism, involving different members of a circle of mimicry of either the Batesian or Mullerian type. The Batesian is one who adopts the form of another to pass for an aposematic species, i.e., striking features that are used as a warning signal to potential predators about effective defenses such as strong and repellent odors or an unpleasant taste or a toxicity that may vary from mild and temporary to mortal (Daly et al., 1994; Darst, Menéndez-Guerrero, Coloma, & Cannatella, 2005). Mullerian mimicry occurs when two species develop evolutionary convergent signals, which indicate they should not be eaten or threatened. Both species are venomous and take advantage of their resemblance so that the predator will remember it more easily.

4 Discussion and Final Considerations

Based on modeled and painted features in pottery, both naturalistic and abstract, we could identify at least four species of endemic amphibians (Figure 4) in the same area where the ceramic group #15 of the regional sequence is distributed (Adán & Alvarado, 1999, p. 255). Various of these vessels have been described up to now as amphibians in a generic form and, in some cases, identified with anthropomorphic, ornitomorphic or abstract figures, and related to a metaphor of fertility. However, we observed that some vessels can display syncretic characteristics of various species, such as the "big mouth" modelled feature defined by Mera and Lobos (2008) to the *Caudiverbera caudiverbera* species.

Once identified to the species level, we observed that among endemic amphibians from the central-southern area of Chile, interesting examples of camouflage have been captured during the Early Ceramic Period, demonstrating a great interaction of local populations with the landscape and its natural resources. The most notorious examples are the representation of mimetic species, among them the *Pleurodema thaul* frog (Figure 4-D) whose eye-shaped glands on its back allow it to resemble larger amphibians and even imitate the prominent snout and general appearance of amphibians such as the Rinhoderma with its tail. It is also worth noting that vessels with "four-eyed" attributes are the most represented in the ceramic collections of the region, possibly because this species cohabits and proliferates around humans and urban environments (Rabanal & Núñez, 2009). The *Rinhoderma darwinii*, or sapo vaquero, with its characteristic snout presents a highly cryptic variety of form and color (Figure 4-C). Another example is *Telmatobufo bullocki* through the representation of its characteristic protuberances in "big mouth" type vessels with cryptic elements but which does not rule out a Batesian mimetic feature (Figure 4-B). While the coloration of *Telmatobufo venustus* is a clear example of aposematism in biology (Figure 3) and which we postulate is represented by black paint on red engobe (Figure 4-A), it has been little explored toxicologically (Correa, Donoso, & Ortiz, 2016).

Amphibians are very plastic at an ecological level. In the face of stress factors such as environmental (climate change) and/or cultural (environment changes induced by humans or the direct exploitation of amphibians), they can change sex, enter torpor or develop toxins. But this same inherent property – the plasticity of the species – makes all these defensive mechanisms temporary because when the external factor that generates stress is reversed, amphibians can also reverse or attenuate these defensive responses. We can explore if certain traits co-occur with periods of environmental stress to which amphibians are extremely sensitive, for example during the Medieval Climatic Anomaly that has been dated between 800 and 1,400 years AD. This period was characterized by its environmental instability, with at least three warm pulses that alternate dry and wet periods (Pérez, 2018), a chronology which is concordant with the archaeological record of this type of modeled and painted decoration on the regional pottery.

To summarize, natural and cultural factors can act concurrently and, in the face of environmental stress, some amphibians become more toxic to avoid predation. We know that all of the aforementioned amphibians contain toxins (for example bufotanina, batratoxina, etc.), in either scarce or abundant forms (Mera & Lobos, 2008). We do not expect *Telmatobufo venustus* with its current aposematic characteristics

to be toxic, although it could have been toxic in the past. Similarly, the external aspects that have survived and characterize it today give it Batesian-type defensive advantages.

Finally, we propose the specialized use of ceramic containers for the storage of toxic substances ethnographically registered in the Valdivia river basin, for both the Panguipulli region (Chile) and in the San Martin de los Andes region (Argentina). We hope future work can contribute to study the toxicological properties of these amphibians in order to contrast this model with an archaeometric approach; however, to date we lack main toxicology data for most of the amphibians from central-southern Chile.

Acknowledgments: To our colleagues Verónica Reyes Álvarez and Doina Munita (Chile) for providing the photographic images used in this work. To the paleontologist Federico Agnolín (Argentina) for the herpetological material and his technical assessment. To the anonymous readers for their interesting comments which contributed to improve this work.

References

Adán, L. & Alvarado, M. (1999). Análisis de colecciones alfareras pertenecientes al complejo Pitrén: Una aproximación desde la arqueología y la estética, en Soplando en el viento. *Actas III Jornadas de Arqueología de la Patagonia* (pp. 245–268). Neuquén, Argentina.

Adán, L. & Mera, R. (2011). Variabilidad interna en el Alfarero temprano del Centro-Sur de Chile. El Complejo Pitrén en el valle Central del cautín y el Sector Lacustre Andino. *Chungara, Revista de Antropología Chilena*, *43*(1), 3–23.

Adán, L. & Mera, R. (1997). Acerca de la distribución espacial y temporal del Complejo Pitrén. Una revaluación a partir del estudio sistemático de colecciones, *Boletín de la Sociedad Chilena de Arqueología*, *24*, 33–37.

Adán, L., García, C., & Mera, R. (2010). La Tradición Arqueológica de los Bosques Templados y su estudio en la región lacustre cordillerana de las regiones IX y XIV (Centro-Sur de Chile). In *Actas y Memorias del XVII Congreso Nacional de Arqueología Chilena* [2006] (pp. 1464–1474). Valdivia, Chile.

Adán, L., Mera, R., Becerra, M., & Godoy, M. (2004). Ocupación arcaica en territorios boscosos y lacustres de la región precordillerana andina del centro-sur de Chile. El sitio Marifilo-1 de la localidad de Pucura. *Chungara, 36*(2), 1121–1136.

Adán, L., Mera, R., Navarro, X., Campbell, R., Quiróz, D., & Sanchéz, M. (2016). Historia prehispánica en la región centro sur de Chile: Cazadores – recolectores holocénicos y comunidades alfareras (ca. 10.000 años a.C. hasta 1.550 d.C.). In Falabella, F., Uribe, M., Sanhueza, L., Aldunate, C., & Hidalgo J. (Eds.), *Prehistoria en Chile. Desde sus primeros habitantes hasta los Incas* (pp. 401–433). Sociedad Chilena de Arqueología.

Adán, L., Reyes, V., & Mera, R. (2001). Ocupación humana de los bosques templados del centro-sur de Chile. Proposiciones acerca de un modo de vida tradicional. In *Actas del IV Congreso Chileno de Antropología*, Los desafíos de la Antropología. Globalización, Sociedad Moderna y Diferencia. In Colegio de Antropólogos de Chile (Eds.) (Vol. 2, pp. 1444–1455). Santiago, Chile.

Aldunate, C. (1989). *Culturas de Chile. Prehistoria desde sus orígenes hasta los albores de la conquista*. Editorial Andrés Bello. Chile.

Aldunate, C. (1996). Mapuche: Gente de la Tierra. In Hidalgo, J., Schiappacasse, V., Niemeyer, H., Aldunate, C. & Mege, P. (Eds.), *Etnografía. Serie Culturas de Chile* (pp. 111–134). Santiago de Chile.

Araya, S., Coloma, E., Correa, E., Correa, M., Wara, M., Penna, M., Saldivia, P., & Velásquez, N. (2011). *Indagando formas, colores y cantos de nuestros anfibios*. Programa Explora, CONICYT, Chile.

Barrientos Romero, R. (2013). *Improntas de hojas en negativo: un aporte metodológico al estudio arqueobotánico de poblaciones alfareras de la Región Centro-Sur de Chile, complejo cultural Pitrén* (Unpublished thesis). Santiago, Chile. Universidad Bolivariana.

Bellelli, C., Carballido, M., & Stern, C. (2018). Obsidianas en el bosque: determinación geoquímica de artefcatos arqueológicos del S-O de Río negro y N-O de Chubut (Patagonia Argentina). *Chungara, 50*(2), 201–216.

Berdichewsky, B. & Calvo, M. (1972–1973). Excavaciones en cementerios indígenas de la región de Calafquén, In Sociedad Chilena de Arqueología (Eds.), *Actas del VI Congreso de Arqueología Chilena* (pp. 529–558). Chile.

Boccara, G. (1999). Etnogénesis mapuche: resistencia y restructuración entre los indígenas del centro-sur de Chile (siglos XVI-XVIII). *Hispanic American Historical Review*, *79*(3), 424–460.

Castro, V. & Varela, V. (1990). *Artífices del barro*. Museo Chileno de Arte Precolombino y Banco de O´Higgins. Santiago, Chile.

Castro, V. & Adán, L. (2001). Abriendo diálogos. Una mirada entre la etnohistoria y la arqueología del área Centro-Sur de Chile: Asentamientos en la zona Mapuche. *Revista Werken*, *2*, 5–35.

Correa, C., Donoso, J.P., & Ortiz, J.C. (2016). Estado de conocimiento y conservación de los anfibios de Chile: una síntesis de los últimos 10 años de investigación. *Gayana, 80*(1), 103–124.

Daly, J.W., Garrafo, M.H., Spande, T.F., Jaramillo C., & Rand, S.A. (1994). Dietary source for skin alkaloids of poison frogs (Dendrobatidae). *Journal of Chemical Ecology*, *20*, 943–955.

Darst, C.R., Menéndez-Guerrero, P.A., Coloma, L.A., & Cannatella, D. (2005). Evolution of Dietary Specialization and chemical Defense in Poison Frogs (Dendrobatidae): A Comparative Analysis. *The American Naturalist*, *165*(1), 56–69.

Dillehay, T.D. (1990). *Araucanía: Presente y Pasado*. Editorial Andrés Bello. Chile.

Dillehay, T.D. & Gordon, A.S. (1979). El simbolismo en el ornitomorfismo mapuche. La mujer mapuche y el ketru-metawe. In H. Niemeyer Fernández (Ed.), *Actas del VII Congreso de Arqueología de Chile* (pp. 303–316). Santiago.

Faron, L. (1964). *Hawks of the Sun: Mapuche Morality and its Ritual Attributes*. University of Pittsburgh Press.

Formas, R. (1979). Los anfibios del bosque temperado del sur de Chile: una aproximación sobre su origen. *Arch. Biol. Med. Exper*. *12*, 191–196.

Formas, R. (1995). Anfibios. In Simonetti, J., Arroyo, M.K. Spotorno, A., & Lozada, E. (Eds.), *Diversidad Biológica de Chile. Comité Nacional de Diversidad Biológica* (pp. 314–325). Santiago.

Formas, R., Núñez, J.I., & Brieva, L.M. (2001). Osteología, taxonomía y relaciones filogenéticas de las ranas del genero Telmatobufo (*Leptodactylidae*). *Revista Chilena de Historia Natural*, *74*(2), 365–387.

Gusinde, M. (1917). Medicina e Higiene de los Antiguos Araucanos. *Revista Chilena de Historia y Geografía*, *27*, 87–120.

Hajduk, A. (1978). Excepcionales ceramios de la provincia del Neuquén. Presencia de alfarería con decoración por pintura resistente en la provincia de Neuquén. Algunas consideraciones en torno a ella. *Revista del Museo Provincial*, *1*, 103–121.

Hajduk, A., Albornos, A., & Lezcano, M. (2011). Espacio, cultura y tiempo: el corredor bioceánico norpatagónico desde la perspectiva arqueológica. In Navarro Floria, P. & Delrio, W. (Eds.), *Cultura y espacio. Araucanía-Norpatagonia* (pp. 262–292). Universidad de Río Negro.

Hilger, M.I. (1957). *Araucanian Child Life and its cultural Background*. Smithsonian Miscellaneous Collections, Vol. 133. Washington.

Joseph, C.H. (1930). Las ceremonias Araucanas. *Boletín del Museo Nacional*, *XIII*, 73–95.

Komárek, S. (1998). *Mimicry, Aposematism, and Related Phenomena in Animals and Plants. Bibliography: 1800–1990*. Vesmir, Prague.

Koessler-Ilg, B. (2003). *El machi del Lanín. Un médico alemán en la cordillera patagónica*. Elefante Blanco, Buenos Aires, Argentina.

Menghin, O. (1962). *Estudios de Prehistoria Araucana*. Acta Prehistórica lll-IV. Buenos Aires, Argentina.

Mera, R. & Lobos, G.A. (2008). Anfibios y reptiles en el imaginario cultural de Chile. In Vidal, M.A. & Labra A. (Eds.), *Herpetología de Chile*, (pp. 55–76). Science Verlag Chile.

Navarro Harris, X., Dillehay, T.D., & Adán Alfaro, L. (2011). Experiencias adaptativas tempranas de vida alfarera en el sector lacustre cordillerano de Villarrica. La ocupación del sitio Pucón 6 (IX Región). *Cazadores Recolectores del Cono Sur, 4*, 59–76.

Ocampo, C., Mera, R., & Rivas, P. (2001). Cementerios Pitrén en el By Pass de Temuco. In *Actas del IV Congreso Chileno de Antropología*: Los desafíos de la Antropología. Globalización, Sociedad Moderna y Diferencia. In Colegio de Antropólogos de Chile (Eds.), (Vol. II, pp. 1465–1472). Santiago de Chile.

Pérez, A.E. (2010a). La Localidad Arqueológica "Lago Meliquina", Dto. Lácar, Neuquén. El registro arqueológico del interior y borde de bosque en Norpatagonia. In Sociedad Chilena de Arqueología (Eds.), *Actas y Memorias del XVII Congreso Nacional de Arqueología Chilena* (pp. 1515–1528). Valdivia, Chile.

Pérez, A.E. (2010b). La Mirada de Ngenechen. Representaciones anfibiomorfas en la alfarería de la Patagonia Noroccidental Argentina. *Comechingonia, 13*, 9–20.

Pérez, A.E. (2011). Algunas reflexiones sobre la alfarería del Centro Sur de Chile y Ambientes Lacustres Precordilleranos de la Patagonia Septentrional Argentina. In Navarro Floria, P. & Delrio, W. (Eds.), *Cultura y Espacio. Araucanía-Norpatagonia* (pp. 293–315). Universidad Nacional de Río Negro. Río Negro, Argentina.

Pérez, A.E. (2016). El registro arqueológico de la cuenca binacional del río Valdivia. La integración de su fuente, el lago Lácar, sector oriental cordillerano. In Nicoletti, M. A., Nuñez, A. & Nuñez, P. (Eds.), *Araucanía-Norpatagonia. Discursos y representaciones de la materialidad* (pp. 167–194). Bariloche, Río Negro, Argentina.

Pérez, A.E. (2018). La Ocupación del Bosque Meridional Neuquíno durante la Anomalía Climática Medieval (800 - 1400 DC). *Arqueología*, *24*(2), 297–301.

Pérez, A.E. & Reyes Álvarez, V. (2009). Técnica improntas de hojas. Algunas reflexiones acerca de su novedoso registro en la vertiente occidental cordillerana. *Magallania*, *37*(1), 113–132.

Pérez, A.E., Reyes Álvarez, V., & Hermann, L. (2012). Alfarería con impronta de hojas por técnica de reserva en la Patagonia Noroccidental Argentina. *Chungara*, *44*(4), 593–603.

Pérez, A.E., Schuster, V., & Castiñeira, L. (2017). Componentes de tecnologías para la pesca (Instrumentos Traful), en ambientes lacustres y boscosos andinos norpatagonicos, Argentina. *Revista CUHSO*, *27*(2), 201–214.

Quiroz, D. & Sánchez, M. (2005). La secuencia Pitrén-El Vergel en Isla Mocha: soluciones de continuidad y distinciones culturales. In Sociedad Chilena de Arqueología (Eds.), *Actas del XVI Congreso Nacional de Arqueología Chilena* (pp. 369–378). Concepción, Chile. Escaparate Ediciones.

Rabanal, F.E. & Nuñez, J.J. (2008). *Anfibios de los Bosque Templados de Chile*. Universidad Austral de Chile, Valdivia.

Reyes, V., Sanhueza, L., & Adán, L. (2003–2004). Alfarería doméstica y funeraria de la Región del Calafquén. *Revista Chilena de Antropología*, *17*, 151–179.

Santos, J.C., Coloma, L.A., & Cannatella, D. (2003). Multiple, recurring origins of aposematism and diet specialization in poison frogs. *PNAS*, *100*, 221–2792.

Summers, K. & Clough, M. (2001). The evolution of coloration and toxicity in the poison frog familiy (Dendrobatiae). *The National Academy of Sciences of the USA*, *98*, 6227–6232.

Velásquez, H. & Adán, L. (2002). Evidencias arqueofaunísticas del sitio alero Marifilo 1. Adaptación a los bosques templados de los sistemas lacustres cordilleranos del centro sur de Chile. *Boletín de la Sociedad Chilena de Arqueología, 33–34*, 27–35.

Veloso, A., Núñez, H., Úbeda, C., Lavilla, E., & Blotto, B. (2004). Pleurodema thaul. In *IUCN 2009. IUCN Red List of Threatened Species. Version 2009.1*