

Associations of Freshwater Mollusks and Extinct Fauna in Kamac Mayu Site during the Late Pleistocene in the Arid North of Chile

Donald Jackson S. and Patricio López M.

Reports on extinct faunal remains from the arid north of Chile are scarce (Bonn and García 2002; Casamiquela 1969–1970, 1999; López et al. 2005; Salinas et al. 1991), as is information about the conditions and environments of deposition. Nevertheless, recent extinct fauna findings in the sites of Kamac Mayu and Betecsca 1 in the arid north of Chile (Alberdi et al. 2007; López et al. 2007) have generated a more complete environmental scene owing to the presence of fauna not previously described for the area, macrobotanical remains, and the identification of associated freshwater mollusks.

Kamac Mayu site is located in the city of Calama (68° 542' 403" W, 22° 262' 203" S), in the arid north of Chile. Stratigraphic excavations 1.80 m deep in a 32-m² area allowed the identification of sedimentation in four stages of deposition (Chong and Jensen 2004): 1) a lacustrine stage; 2) stage of karstic erosion; 3) fluvial stage; 4) stage of calcareous cementation. The first stage consists of pulverized marl and diatomites from the Chiu-Chiu Formation dated to the Plio-Pleistocene. During the second stage an erosional surface was formed by dissolution cavities, followed by a fluvial system of clastic sediment. The third stage (fluvial) consists of sandy gravel and sand deposits that filled a series of channels of the karstic formation; the deposition process predates the present Loa River and the period in which the extinct faunal remains would have been deposited (López and Labarca 2005).

The fossil fauna includes remains of at least one juvenile and one adult *Hippidion saldiasi*, five *Macrauchenia* sp. adults, a juvenile Edentata of undetermined genus and species, and camelid remains without assignment to genus, but with affinities with *Lama gracilis* (López et al. 2007). This faunal assemblage is the result of the natural death of the animals in lacustrine situations, suggesting that they were redeposited downstream from the original place of death (López and Labarca 2005). Nevertheless, the presence of *Macrauchenia* crania that could have “anchored” more easily than other bones reveals the probable place of death and the fluvial transport of the remaining bones.

The record of a lacustrine and humid environment at the moment of death and deposition of the faunal remains is also revealed by the presence of five species of freshwater mollusks and one species of micro-mollusk. Among the freshwater mollusks, two species from the Planorbidae family were found, with only one genus in Chile represented by *Biomphalaria*, with a total of seven

Donald Jackson S., Departamento de Antropología, Facultad de Ciencias Sociales, Universidad de Chile, Ignacio Carrera Pinto 1045, Ñuñoa, Santiago, Chile; e-mail: djackson@uchile.cl

Patricio López M., Instituto de Investigaciones Arqueológicas y Museo, Universidad Católica del Norte, Calle Gustavo Le Paige 380, San Pedro de Atacama 141-0000, Chile; e-mail: patriciolopezmend@yahoo.es

species (Valdovinos 2006), of which only *Biomphalaria costata*, *Biomphalaria thermali*, and *Biomphalaria aymara* are from the Andean highlands of northern Chile (Valdovinos and Stuardo 1991). Other mollusks correspond to the Hydrobiidae family, represented by at least two undetermined species of the *Littoridina* genus, for which 21 species are known in Chile (Valdovinos 2006), with six species distributed currently in the arid north of Chile (15°–25° S) (Valdovinos 1999).

Likewise, a species of freshwater bivalve from the Sphaeriidae family was found. Although the genus and species were not determined, it could correspond to *Pisidium meierbrooki*, *Sphaerium lauricochae*, or *Sphaerium forbesi*, the only genera and species of this family from the Andean highlands of Chile, Perú and Bolivia (Parada and Peredo 2006).

The highest frequency for mollusks is represented by a micro-gastropod from the Endodontidae family, of unidentified genera and species. In Chile this type of mollusk is represented by at least seven genera and 30 species (Valdovinos 1999), none of which is currently found in the arid north of Chile (15°–25° S). This may indicate their paleodistribution and later regional extinction.

The different genera and species of the Planorbidae, Hydrobiidae, and Sphaeriidae families identified in the context associated with the extinct fauna correspond to freshwater mollusks that are currently found in lake and river environments from the north-center and south of Chile. The species of the Endodontidae family are micro-gastropods usually found under the foliage of humid environment vegetation.

This evidence indicates that the mammals associated with the Kamac Mayu site in the late Pleistocene (López et al. 2007) lived in a lacustrine environment, probably small lakes and marshes, with oasis vegetation and small bushes, as observed in the Chiu-Chiu micro-basin today. Probably the advent of arid conditions was related to the death of these mammals and the associated mollusks. A similar situation can be suggested for nearby sites with extinct fauna, such as Betecsa 1 (Alberdi et al. 2007) and Ojos de Apache (López et al. 2005), both located in the great basin of Calama in the arid north of Chile.

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