



Comment on “The oldest South American Cricetidae (Rodentia) and Mustelidae (Carnivora): Late Miocene faunal turnover in central Argentina and the Great American Biotic Interchange” by D.H. Verzi and C.I. Montalvo [Palaeogeography, Palaeoclimatology, Palaeoecology 267 (2008) 284–291]

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ABSTRACT

In a recent paper (Verzi, D.H., Montalvo, C.I., 2008. The oldest South American Cricetidae (Rodentia) and Mustelidae (Carnivora): late Miocene faunal turnover in central Argentina and the Great American Biotic Interchange. *Palaeogeography, Palaeoclimatology, Palaeoecology* 267, 284–291) the potentially oldest South American Cricetidae (Rodentia) and Mustelidae (Carnivora) have been reported from a Late Miocene (Huayquerian) assemblage located in central Argentina (Caleufú site, La Pampa province). These findings expand the biochron of these important families in South America 3–4 Ma earlier than previous records. However, several observations prevent us from accepting the validity of these assumptions. In this paper we discuss the age of the Caleufú assemblage, and the assignment of the GHUNLPam 21722 to Mustelidae. The Caleufú assemblage contains a mixture of Pliocene and Late Miocene faunal elements, and has been assigned to the Huayquerian only due to the “stage of evolution” of some rodents. The lack of isotopic or paleomagnetic data coupled with the isolation of this locality and the absence of a local stratigraphic succession inhibit its correlation with other palaeontological comparable sites and a robust inference about its chronology. The “stage of evolution” of a taxon is not a biostratigraphic tool, thus we cannot rule out the possibility that the Caleufú assemblage has an Early Pliocene (Montehermosan) age. The GHUNLPam 21722, a poorly preserved specimen, shows several characters (e.g., 4 lower incisors, mental foramina below the incisors absent, third lower incisor smaller than the first and second ones) that do not match with Mustelidae (or Carnivora) but instead strongly resemble those observed in didelphimorphian marsupials. The discussed caveats regarding Caleufú assemblage chronology and taxonomy indicate that new and detailed studies are needed before the hypotheses advanced by Verzi and Montalvo can be accepted.

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1. Introduction

Twenty years of collection and study plus more than a decade of publications made by Montalvo and collaborators place the paleofauna of the Cerro Azul Formation (La Pampa Province, Central Argentina) within the best known latest Neogene faunistic assemblages in southern South America (see Verzi et al., 2008, and the references therein). In this context, we want to call to attention a single paleontological locality, Caleufú, recently addressed by Verzi and Montalvo in this journal (Verzi and Montalvo, 2008; VM, thereafter). Caleufú faunistic assemblage was claimed as Late Miocene (late Huayquerian) in age and therefore bearing the “oldest” remains

of the most diverse subfamily of Neotropical rodents (Cricetidae, Sigmodontinae) and one group of placental carnivores (Mustelidae).

Two main points will be discussed in this contribution: (1) the age of the Caleufú assemblage, and (2) the taxonomic identity of the supposed Carnivora. We present here strong arguments that make the results and interpretations of VM equivocal regarding both issues. Therefore, our interpretation calls into question two fundamental subjects of VM original paper: (1) the biostratigraphy of the Caleufú fauna is weak (therefore, the proposed Late Miocene age for this fauna is arguable), and (2) the taxonomic identification of the poorly preserved mustelid specimen may actually represent an endemic marsupial rather than an early carnivore immigrant (therefore, the biochron of Mustelidae in South America is not increased by 3–4 Ma). Both of the points here discussed are crucial, since they change our knowledge of the calibration of Late Miocene southward dispersal (from North America into South America) during the early phases of the Great American Interchange.

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2. The age of Caleufú assemblage

The Caleufú assemblage emerges as a “rara avis” (from Latin, “rare bird,” a rare thing or rarity) within 20 localities, where sediments of Cerro Azul Fm are exposed. This faunal association has yielded unique fossil remains that includes sigmodontines, “mustelids” (but see below), plus a large list of endemic taxa. Most of the rodents present in Caleufú are new species or, at least, specimens slightly different from other known Late Miocene species (either from other Cerro Azul assemblages or from other putative coeval Argentinean northwestern assemblages). The following are some examples: (1) the species of the cavid *Neocavia* from Caleufú is, according to Montalvo and Rocha (2003, p. 504), more derived than *N. lozanoi*, typical of Huayquerian beds; (2) although VM (Table 1) indicates *Neophanomys biplicatus* as one octodontid present in the Caleufú assemblage, this specific status was questioned by Verzi et al. (2008, p. 152) “A new chronomorph of the octodontid *Neophanomys*, more derived than *N. biplicatus*...” (see also VM, p. 287); (3) the octodontid *Xenodontomys* is represented in Caleufú by an exclusive species, *X. elongatus* (see Verzi et al., 2003). In addition to rodents, another well known group of mammals recorded in Caleufú are the armadillos (Dasypodidae) mainly because of the revision of Urrutia et al. (2008; and the references therein). The authors also consolidated the “rara avis” condition of Caleufú with the recognition of *Ringueletia*, a genus previously known from Pliocene Montehermosan–Marplatense beds (Cione and Tonni, 1996; Cione and Tonni, 2005). Finally, the record of marsupials from the Caleufú assemblage (Abello et al., 2002) is also worth mentioning. The exclusive record of the genus *Argyrolagus* departs from the widespread occurrence of *Microtragulus* in the remaining assemblages of the Cerro Azul Fm (Goin et al., 2000).

The crucial issue is the reference of Caleufú assemblage to the Late Miocene (late Huayquerian). VM supported this conclusion by developing a biochronological scheme based on the grade of evolution of two octodontid lineages, *Chasichimys*–*Xenodontomys*–*Actenomys* and *Neophanomys*. Tacitly in VM and several other contributions (e.g., Verzi et al., 2003, 2008), the genus *Actenomys* (widespread during Neogene times in Central Argentina) seems to be indicative of post-Huayquerian beds, while *Chasichimys*–*Xenodontomys* from Chasicóan–Huayquerian levels. But in a specific paper devoted to the taxonomy of *Xenodontomys*, Verzi et al. (2003) considered (a) the difficulty to separate larger *Xenodontomys* species (like *elongatus*) from smaller *Actenomys* species (like *priscus*), and (b) the high degree of variance represented in *X. elongatus* measurements (see Verzi et al., 2003, Figs. 7–8). These two elements clearly tackled the potential value of *X. elongatus* as a chronological indicator. According to our view, the weakest point of the biochronology proposed by Verzi and collaborators is the lack of stratigraphic succession of, at least, two putative successional chronomorphs of the line *Chasichimys*–*Xenodontomys*–*Actenomys*. Following the authors: “Since there is no stratigraphic superposition among the studied levels, the following scheme of biostratigraphic and biochronological correlation among the bearing units is based on the stage of evolution of octodontoid rodents...” (Verzi et al., 2008, p. 150). None of the 20 paleontological localities of the Cerro Azul Fm permits comparison of their stratigraphical columns, the change from one form into another. In other words, their biochronology is based on findings from isolated localities linked and “arranged” by a presumptive evolutionary order of the octodontid lineage. In this context, the possibility of circular reasoning is very high, leading to their hypotheses being weakly supported.

The interpretation of the chronological order of these localities based on the “stage of evolution” of some taxa stated by VM clearly does not constitute a biostratigraphic argument (e.g. Hedberg, 1980; Código Argentino de Estratigrafía, 1992; Woodburne, 2004), and, in the absence of other kind of information, it is not possible to ascertain the relative age of each locality. Thus, to be a biostratigraphic tool, the

“biochronological” schema of the rodents studied by VM must be based on a sequence where the superposition of each stratum with rodents in different “stages” of evolution could be observed, or on isotopic dates or paleomagnetic analysis. In consequence, this biochronological interpretation is not a robust argument to expand the earliest occurrence of cricetids and “mustelids” in South America.

The issue is, in addition, related to the chronological position of the “Irenean”. In this regard, VM (see also Verzi et al., 2008, p. 151–152) unequivocally positioned the “Irenean” in the Late Miocene (late Huayquerian) and considered this bed in part to be older than the Caleufú assemblage. The authors based this inference on the occurrence of *Xenodontomys ellipticus*, a more “primitive” species than *X. elongatus* present in Caleufú, but younger than the Barranca de Sarmiento and Cantera Seminario sites because it is a more “derived” *X. ellipticus* “chronomorph” than the one present in the latter localities (Verzi et al., 2008, p. 152). This “derived” *X. ellipticus* “chronomorph” is present only in some exposures of the Irene Formation (Arroyo Indio Rico, Irene, Paso del Médano and Oriente, Verzi et al., 2008, p. 151–152). If this schema is correct, the time span represented by the Caleufú fauna is not represented in the Irene Formation, where post-Huayquerian rodents (*Actenomys*) were recovered in some localities (i.e. Cascada Grande, see below) or older Huayquerian rodents (*Xenodontomys ellipticus*) from others (see below).

In order to reinforce this point, a brief historical review of this faunistic unit is presented here. The term “Irenean” (“Irenense” in Spanish) was introduced by Kraglievich (1934) to characterise a group of poorly known paleofaunas collected from isolated outcrops from south-central Buenos Aires Province, mainly exposed in or near the Quequén Salado River and one of its tributaries, the Indio Rico Creek. Fidalgo et al. (1975) introduced for the first time the term Irene Formation to refer to these deposits. The principal paleontological locality is Cascada Grande (= Cascada Cifuentes or Cascada Aldaya) along the sides of the Quequén Salado River. The sedimentary exposures achieve a thickness of eight meters and are arranged in several tabular banks (Mignone, 1949). Other fossiliferous localities along this river are restricted to isolated and patchily distributed riverine cliffs, no larger than 300m long and less than three meters thick, the best known of which is Paso del Médano (in the place locally known as Cueva del Tigre), ca. 11 km above the mouth of the Quequén Salado River (e.g., Reig, 1955; Pascual and Herrera, 1973; Goin et al., 1994). Early paleontological material considered by Kraglievich (1934) to define the “Irenean” came from Irene, Oriente, and Indio Rico localities. These localities were never revisited because the exact position of the deposits is unknown and the collections lack associated stratigraphical data. Despite that, VM used the presence of *Xenodontomys ellipticus* in these historical collections to position the “Irenean” in the Late Miocene, older than the Caleufú assemblage. An internal contradiction of this statement – overlooked by VM – is that if the “Irenean” of Paso del Médano is older than Caleufú, then the cricetid remain recovered there (see Pascual and Herrera, 1973, p. 48) is older than the presumed “oldest” Cricetidae from Caleufú.

Summarizing the facts mentioned above, the chronology of the Caleufú assemblage is, at least, controversial, and its assignment to post-Huayquerian stages (early Pliocene, as was suggested in several studies previous to VM; see, e.g., Montalvo et al., 2000) cannot be ruled out without more solid arguments (e.g., stratigraphy, radio-metric dates). The difficulties to unequivocally assessing the antiquity of Caleufú are in line with other Central and Western Mio-Pliocene paleofaunas of Argentina (see Tauber, 2000, 2005). In order to explore this important issue, a promising way could be a revisionary work of the Quequén Salado river beds and its fossils. We and our collaborators made extensive collections in Cascada Grande, Paso del Médano, and other small riverine cliffs along the Quequén Salado river, during the years 1991–1998. These collections, including thousands of fossil remains with precise stratigraphical provenance, are housed in La Plata Museum but have remained basically unstudied. A preliminary

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