

PRESENCE OF *LATONIA* (ANURA, DISCOGLOSSIDAE) IN THE INSULAR PLIOCENE OF MENORCA (BALEARIC ISLANDS)

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Resum

S'ha trobat per primera volta al Pliocè de Menorca (Illes Balears) el gènere extingit de discoglòssid *Latonia*. Ha estat detectat a Punta Nati 6 i Punta Nati 12, dues localitats d'origen càrstic que es poden datar al Pliocè, però en canvi no s'ha trobat al Pleistocè de Menorca ni de cap altra de les Balears. La *Latonia* insular menorquina probablement representa una espècie no baptiada, però els seus elements cranians més diagnòstics encara no s'han trobat. Al Pleistocè de Mallorca i Menorca s'han trobat representants de gran mida del gènere *Discoglossus*. No obstant això, les dades moleculars i paleontològiques indiquen que la línia evolutiva de *Discoglossus* no prové directament de cap *Latonia* del Neògen. Menorca va mantenir durant el Pliocè una condició insular, i la *Latonia* de Menorca podria ser o bé un antic nadiu pre-messinià o bé un immigrant messinià. A llavors, les presències successives de *Latonia* i *Discoglossus* a les Illes Balears probablement representen esdeveniments diferents d'immigració i extinció.

Abstract

The extinct discoglossid genus *Latonia* has been recovered for the first time in the Pliocene of Menorca (Balearic Islands). *Latonia* has been detected in Punta Nati 6 and Punta Nati 12, two localities of karstic origin that can be dated in the Pliocene, but it has not been found in the Menorcan Pleistocene, nor in the Pleistocene of any other Balearic island. The Menorcan insular *Latonia* probably represents an unnamed species, but their taxonomically most diagnostic cranial elements have not been found yet. Representatives of the living genus *Discoglossus*, of large size, have been identified in the Pleistocene of Mallorca and Menorca. However, molecular and palaeontological data indicate that Pleistocene *Discoglossus* lineages are not direct descendants of any Neogene *Latonia*. Menorca has maintained during the Pliocene an insular status, and Menorcan *Latonia* could be an old pre-Messinian native relict or a Messinian immigrant. Therefore, the successive presences of both *Latonia* and *Discoglossus* in the Balearic Islands probably represent separated immigration and extinction events.

Resumen

Se constata por primera vez la presencia de *Latonia*, un género extinto de discoglósidos, en el Plioceno de Menorca (Islas Baleares). *Latonia* se ha encontrado por el momento en Punta Nati 6 y Punta Nati 12, dos yacimientos de origen càrstico datados como pliocenos, pero no se ha encontrado en el Pleistoceno de Menorca ni tampoco en el Pleistoceno de ninguna otra isla balear. Este representante insular de *Latonia* posiblemente pertenezca a una especie todavía innominada, pero no se han encontrado aún los elementos craneales taxonómicamente más informativos en este grupo. Se han identificado representantes del género actual *Discoglossus*, de talla grande, en el Pleistoceno de Mallorca y Menorca. Sin embargo, los datos moleculares y paleontológicos indican que los linajes pleistocenos de *Discoglossus* no son descendientes directos de ninguna *Latonia* del Neógeno. Menorca ha mantenido su condición insular durante todo el Plioceno, y *Latonia* en la isla puede ser un antiguo relict pre-mesiniense o un inmigrante mesiniense. En consecuencia, las presencias sucesivas de *Latonia* y *Discoglossus* en las Islas Baleares probablemente representen diferentes eventos de inmigración y extinción.

INTRODUCTION

The batrachian insular faunas are in general poorly known from a palaeontological point of view. In the case of the Balearic Islands, with the exception of few fragments from the Upper Oligocene, the available fossil record has been recovered in Tardiglacial, Pleistocene and Holocene sites (Alcover *et al.*, 1984; Sanchiz, 1998), and therefore there is no direct information on its Neogene faunal history.

A recent palaeontological survey made by some of the authors in karstic filling deposits from the NW of the island of Menorca has resulted in the discovery of several sites that have yielded anuran samples of presumably

Pliocene age. In this note we provide a preliminary description and identification of these first Neogene Balearic amphibians, in the hope that future research will allow a more complete view of their evolutionary history.

FOSSIL LOCALITIES AND TAPHONOMY

Quintana (1998) gives a general geological and geographical setting of the fossil sites Punta Nati 6 and Punta Nati 12, near the town of Ciutadella de Menorca. Pending future analyses, an accurate geological dating by direct criteria is not yet possible, but nevertheless the karstic

sediments containing the fossil anurans fill in Uppermost Miocene (Messinian) calcarenites, and are covered by Pleistocene red slimes, thus providing an indeterminate Pliocene age (Quintana, 1998, 2001). A giant rabbit (Quintana, this volume) and the large tortoise *Cheirogaster gymnesica* (Quintana, 1998, 1999) predominate among the vertebrates present in these assemblages. Other herpetological remains previously studied include viperid and colubrid snakes (Bailon *et al.*, 2002, and this volume), amphisbaenids (García-Porta *et al.*, 2002) and geckos (Bailon *et al.*, this volume).

Concerning taphonomy, in Punta Nati 6 the anurans are mixed with all the other vertebrates and some evidence of transport can be observed. However, in Punta Nati 12 there is no apparent transportation of sediments, and the amphibians are mostly concentrated in centimetric accumulation layers (Fig. 1). However, in both localities the fossil anurans probably derive from the predation of nocturnal birds of prey, most likely from the extinct large owl *Tyto balearica*.

Comparative material

Dry disarticulated skeletons belonging to the collection of the Museo Nacional de Ciencias Naturales (CSIC, Madrid) have been used. They include all the living *Alytes* and *Discoglossus* species, with the exception of *D. montalentii* which was loaned by M. Delfino (Florence). Terminology follows Sanchiz (1998).

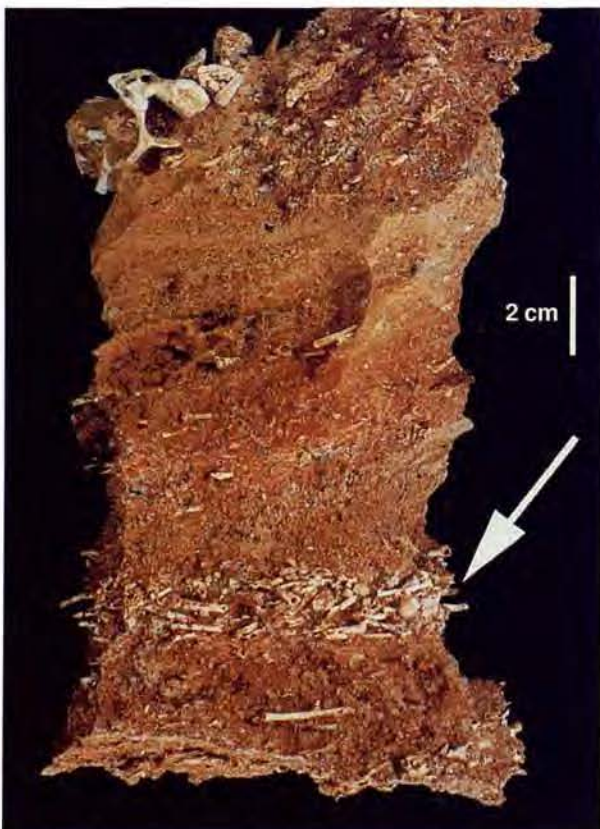


Fig. 1. Sample of the deposit Punta Nati 12. An arrow indicates the thin layer in which most of the amphibians are found.

Fig. 1. Mostra del depòsit Punta Nati 12. Una fletxa indica la capa prima on s'han trobat la major part dels amfibis.

SYSTEMATIC PALAEOLOGY

Family Discoglossidae Günther, 1859 "1858"

Genus *Latonia* Meyer, 1843

Latonia sp.

Material: Most of the elements recovered are incomplete fragments, extracted from the sediment by acetic acid techniques. The material from Punta Nati 6 and 12 is currently deposited in the Institut de Paleontologia M. Crusafont (Sabadell) (IPS), with the exception of a small sample from Punta Nati 6 which is stored in the private collection of Josep Quintana (Ciutadella de Menorca) (CJQ).

Punta Nati 6: Premaxillar fragment (IPS 1); sphenethmoid (IPS 1); frontoparietal fragment? (IPS 1); prootic-exoccipital (IPS 1); angulosplenial (IPS 1); atlas (IPS 1); V2-V4 (CJQ 1; IPS 2); V5-V8 (CJQ 2; IPS 3); vertebral centra (CJQ 1; IPS 1); sacral vertebrae (CJQ 3; IPS 2); urostyles (CJQ 3; IPS 1); scapulae (IPS 5); cleitra (IPS 1); humeri (CJQ 2; IPS 3); radioulnae (CJQ 3; IPS 5); ilia (CJQ 3; IPS 12); femora (CJQ 1; IPS 1); tibiofibulae (CJQ 2; IPS 12). In this site several bones (humeri, femora and tibiofibulae) have been found with signs of pathological processes and traumatism, similar to those described by Sanchiz & Pérez (1974), which will be published elsewhere.

Punta Nati 12: Prootic-exoccipitals (IPS 8); cleithra (IPS 2); scapulae (IPS 2); humeri (IPS 2); ilia (IPS 3); ischium (IPS 1); femora (IPS 8); tibiofibulae (IPS 14); tibiale-fibulare (IPS 1).

DESCRIPTION

Most of the material is fragmented and badly preserved, but all the recovered elements show the typical discoglossine features, at the subfamily level, basically in full agreement with the described *Discoglossus* and *Latonia* morphologies. These general discoglossine features will not be commented here, being available in many earlier works (e.g. Púgner & Maglia, 1997; Rage & Hossini, 2000; Roček, 1994). Moreover, there is no evidence that could suggest the presence of more than one taxon in the samples.

Skull

A minute fragment showing not very dense tubercular ornamentation (Punta Nati 6) might perhaps come from the most anterior frontoparietal region, but the attribution of this fossil must remain open to question. If the assignment of this fragment to the anuran sample is confirmed, it would indicate the presence of *Latonia*, but would be taxonomically uninformative within the genus. The available fragments of sphenethmoid and prootic-exoccipital are damaged, and being its variation not very well known within *Latonia* species, they cannot provide any specific identification. The only angulosplenial in the sample is broken and the paracoronoid tubercle cannot be observed.

Vertebral column

Vertebrae from all the different regions of the column have been recovered. They all agree with the morphology



Fig. 2. *Latonia* sp. (CJQ uncataloged). Punta Nati 6. Sacral vertebra in dorsal view.

Fig. 2. *Latonia* sp. (CJQ no catalogat). Punta Nati 6. Vertebra sacra en norma dorsal.



Fig. 3. *Latonia* sp. (CJQ 1339). Punta Nati 6. Right radioulna in lateral view.

Fig. 3. *Latonia* sp. (CJQ 1339). Punta Nati 6. Radioulna dreta en norma lateral.

present in *Latonia*, which is not very different among species, and also similar to the *Discoglossus* one. Nevertheless, a complete sacrum (Fig. 2) shows a shape of the transverse processes that allows the distinction between *Discoglossus* and *Latonia*. The sacral wings are more posteriorly oriented than in typical *Discoglossus*, and the width of its distal part is in proportion smaller, particularly in relation with the proximal part (narrower in *Discoglossus*). These sacral features have never been properly quantified, and we cannot exclude that extreme variants of *Discoglossus* could approach the fossil morphology, but at least qualitatively the distinction seems clear. The urostyle shows a small lateral crest, less developed than in specimens of *Latonia gigantea* of roughly similar sizes. In *Discoglossus* this urostyle crest is almost absent or merely a longitudinal ridge.

Pectoral girdle

The scapular fragments agree with the morphology of both *Latonia* and *Discoglossus*. Distinction between these genera might become possible from a biometrial point of view, but no data of this sort has been published yet. The cleithral fragments are not taxonomically informative.

Forelimb

Humeral and radioulnar (Fig. 3) remains, in the absence of a statistical sample, provide no reliable features to distinguish between *Discoglossus* and *Latonia*.

Pelvic girdle

Several almost complete proximal parts of the ilium have been recovered (Fig. 4). Besides other discoglossine features, these ilia present a rather flat *tuber superior* continued by a dorsal crest, a long *pars ascendens* and a highly reduced *pars descendens*. This type of *tuber superior* and particularly the *pars descendens* are similarly found in *Latonia*, but they differ from corresponding morphologies present in all *Discoglossus* species, in which a rather dorsally swollen *tuber* and a small but clearly developed *pars descendens* can be observed. The ilial morphology, as described above, is a strong indication in favour of the taxonomic attribution of this sample to the genus *Latonia*. The distinction seems qualitatively clear, and many biometric approaches can quantify it (e.g., Sanchiz & Alcover, 1984).

Hindlimb

The main locomotor's segments of the leg show similar morphologies in all discoglossine groups, and the available fossil samples (in Menorca and elsewhere) do not allow any statistical taxonomic discrimination.

Size

The genus *Latonia* is one of the largest anurans known (Roček, 1994). No statistical analyses are possible at this point, but the Menorcan *Latonia* seems to attain similar sizes than the giant continental Miocene and Pliocene *L. gigantea* (Rage & Hossini, 2000; Roček, 1994).

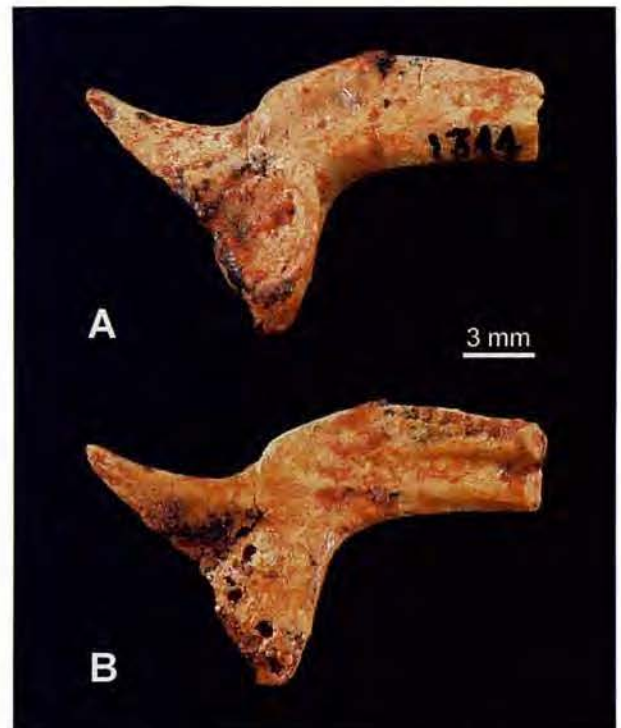


Fig. 4. *Latonia* sp. (CJQ 1344). Punta Nati 6. Right ilium in external (A) and inner (B) lateral views, the later reversed for an easier comparison.

Fig. 4. *Latonia* sp. (CJQ 1344). Punta Nati 6. Ilium dret en norma lateral externa (A) i interna (B); la darrera foto, invertida per permetre una comparació més fàcil.

DISCUSSION

The genus *Latonia* is one of the most frequently found anurans in the European Tertiary, with a Neogene distribution from Iberia to Russia and Anatolia (Roček & Rage, 2000; Rage & Roček, 2003). During the Pliocene a possible gradual withdrawal of *Latonia* from Central Europe to the Mediterranean has been suggested (Rage & Roček, 2003). Similar forms are known as early as the European Maastrichtian (Venczel & Csiki, 2003), and also from the Miocene of Morocco (Sanchiz & Alcover, 1984; Hossini, 2000). *Latonia* seems to have become extinct in the Lower Pleistocene, being Pietrafitta (Italy) the youngest locality where it has been recorded (Rage & Roček, 2003). The Menorcan insular *Latonia* probably represents an unnamed species, but their taxonomically most diagnostic cranial elements have not been found yet.

If we accept that transmarine migrations are unlikely ways for anuran dispersion (but see Vences *et al.*, 2003), the Western Mediterranean palaeogeographical history (e.g. Fromhage, *et al.*, 2004; Martínez-Solano *et al.*, 2004) provides two possible scenarios to explain the presence of *Latonia* in the insular Pliocene of Menorca: either a) *Latonia* is a native pre-Messinian relict on the island, present at least after the Langhian-Serravalian transition (or even pre-Miocene), or b) *Latonia* is a Messinian immigrant, its insular status attained after the end of the Mediterranean Salinity Crisis, dated 5.33 Ma ago (Krigsman *et al.*, 1999). Unfortunately, the only identifiable pre-Pliocene anuran recorded in the Balearic Islands is a maxillary fragment from the Upper Oligocene of Peguera (Mallorca), assigned to *Eopelobates* because of its cell-like polygonal ornamentation (Sanchiz, 1977). A misidentification for *Latonia* is unlikely, because *Latonia* maxillae vary within species from having smooth surfaces to a tubercular sculpture (sometimes aligned) covering only a triangular area in the posterior part of the bone (Roček, 1994). *Latonia* has been recorded only in Menorca, but we cannot exclude its Pliocene presence in Mallorca because localities of this age, including amphibians, have not been found in this island.

In both Mallorca and Menorca an extinct fossil *Discoglossus*, larger in size than any other species, has been found in the Pleistocene. Against the opinion of Roček & Rage (2000), the living *Discoglossus* lineages, including the Balearic form, cannot be considered as direct descendants of Neogene *Latonia*. Both the fossil record (e.g. Sanchiz, 1998; Venczel, 2004) and the molecular time studies on *Discoglossus* (*sensu stricto*) diversification (Fromhage, 2004; Martínez-Solano, 2004) give earlier time estimations for its origin. Therefore, the successive presences of both *Latonia* and *Discoglossus* in the Balearic Islands probably represent separated immigration and extinction events.

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