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AFRICAN FOSSIL LISSAMPHIBIA

by

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ABSTRACT

The Anura (Frogs and Toads) are represented in Africa and associated regions by fossils of every epoch from the Cretaceous to the Holocene. Pipid frogs of African affinity are known from the Early Cretaceous of Israel and Later Cretaceous of South America and Africa; those of Israel and South America have been well-studied, but only one from Africa has been: *Eoxenopoides reuningi* from Namaqualand. Two well-studied Palaeocene frogs of South America, *Shelania pascuali* and *Xenopus romeri*, have affinities with the African pipids. Apart from a Miocene assemblage from North Africa (including pipids, which are now exclusively sub-Saharan) and one species from Namibia, *Xenopus stromeri*, the fossil African anurans remain largely unstudied. Deposits in which the African anuran fossils occur represent crater lakes, other lacustrine deposits, including lacustrine tuffs, river terraces, deltas, estuarine/lagoon zones, karst landscapes and archaeological sites; data are not available for several of the recorded fossils. No fossils in Africa appear to have been definitely ascribed to the Urodela or Caecilia.

INTRODUCTION

At a symposium on African Anura in January 1994 a computerized bibliography programme was demonstrated (Van Dijk, in press). The collection of literature, and the bibliography based on it, was started more than thirty years ago. Many items obtained, although relevant for the study of African Anura, had never been referred to in this connexion, or were only encountered in the reference lists of other articles. This was often the case with references relevant to fossil African Anura or related fossils. What is here presented is a review of the literature extracted from the computerized bibliography, to indicate the state of knowledge of the field and to point out references to fossils which await study.

REVIEW OF DATA

The Lissamphibia include three orders of Amphibia. Of these the legless Caecilia (= Apoda; = Gymnophiona) are known from only a single fossil species from South America, which appears to be related to a living West African species. The Urodela (newts and salamanders) occur in Africa only north of the Sahara, and have not been included in the literature collection or bibliography. There are in fact very few references to fossil urodeles in Africa. The comprehensive study of Estes (1981) lists no described fossil urodele. One Holocene site in East Africa lists Nectridia among the fossils (Andrews *et al.*, 1981). The Nectridia became extinct in the Permian, hence any lower vertebrate fossil with a tail at the site, if it is an amphibian, is more likely to be a urodele, with a remarkable distribution. De Broin, *et al.*(1974) found one specimen or species in the Cretaceous of Niger which they considered to resemble a Urodele – "Il semble d'autre part exister dans le gisement un Urodèle de grande taille dont la position systématique reste à préciser". Estes (op. cit.) refers to urodeles from this site, and to work in progress on them (Estes & Rage, in preparation), but no publication could be traced. (Estes is now deceased). Of the Lissamphibia it is the Anura, the frogs and toads, which are at present overwhelmingly of interest in Africa as fossils, because of their numbers and because of the sureness with which they can be identified as anurans. The distribution of anuran fossils in Africa, and related ones, is summarized in the Table and Map.

DISCUSSION

In this discussion, only the most important diagnostic features will be mentioned. The oldest fossil considered to be an anuran is *Triadobatrachus* (Piveteau 1936a, 1936b, 1937; Estes & Reig 1973; Rage & Rocek 1984), from the Triassic of Madagascar. That it is an amphibian is shown by the presence of only one sacral vertebra. The short tail and small number of presacral vertebrae, reduced ribs, and forward projection of the ilia, are characteristics of Anura.

A fossil of early Jurassic age, from South America, named *Vieraella herbstii*, is very like modern Anura and is in fact assigned to the modern family Ascaphidae. By the Early Cretaceous three modern families, Ascaphidae (from South America), Discoglossidae (from Spain), and Pipidae (from Israel) are known, probably having diverged in the Jurassic. Ascaphidae have not been found in Africa, while living Discoglossidae in Africa are confined to North of the Sahara. A Miocene discoglossid has been reported from Morocco (Sanchiz & Alcover 1984).

The Pipidae, now sub-Saharan in Africa (and South American), occur as fossils in North Africa, while some South American fossils have close affinity to living African genera. The Pipidae are distinguished by loss of

CAENOZOIC				
Holocene				
Late Stone Age, Iron Age	Anura indet.	**archaeological site**	Matupi Cave; **NE Zaire**	van Neer 1984
Middle & Late Stone Age	*Pyxicephalus*+?	**archaeological site** Kumakams, Bremen; **Namibia**	Zebrarivier, Maguams Avery 1984	Cruz-Uribe & Klein 1983;
Pleistocene	amphibia	**lacustrine crystal tuffs**	Olduvai Gorge, Bed I; **Tanzania**	Leakey 1967
Pliocene/Pleistocene	cf. *Xenopus*	**deltaic, estuarine, lagoonal**	Langebaan; **South Afica**	Hendey 1967
	Anura	**calcareous cave breccia**	Transvaal Caves; **South Africa**	
Pliocene				
?Mio-/?Pleistocene	?cf. *Xenopus*	**terrace, volcnaic terrain**	Kleinsee, Namaquland; **South Africa**	Stromer 1931
Miocene	*Xenopus; Ptychadena; Bufo*	**karst landscape**	Beni-Mellal; Morocco	Hecht *et al.* 1961 Vergnaud-Grazzini 1966
	Anura; Nectridia	**muds, marls, silts; ?tuffaceous**	Makobo Island, Lake Victoria; **Kenya**	Andrews *et al.* 1981
	amphibia	**terrace deposits**	Arrisdrift; **Namibia**	Hendey 1978
	Xenopus stromeri	**terrace, ?volcanic terrain**	borehole near Elizabethbucht; **Namibia**	Stromer 1925; Ahl 1926
Oligocene	*Xenopus (Libycus) hasaunus*	?	Jabal al Hasawinah; **C. Lybia**	Spinar 1980
Eocene	amphibians	**lacustrine/fluviatile**	El Kohol, near Brezina; **Algeria**	Mahboubi *et al.* 1986
Palaeocene				
Upper	*Shelania pascuali#*	*?*	*Laguna del Hunco, Chubut;* Patagonia, **Argentina**	*Casamiquela 1960,* ***1961***, 1965; Estes 1982; Baez 1983
Upper	*Xenopus romeri* **	***fissure in limestone***	Sao Jose' de Itabori; **Brazil**	**Estes 1975a; 1975b, 1982**
Mesozoic				
Cretaceous				
Upper	*Eoxenopoides reuningi*	**crater lake**	Banke, Namaqualand; **South Africa**	Haughton 1931; Estes 1977
Upper	pipid; cf. *Eoxenopoides reunigi*	crater lake	Stompoor, Maryvale; Namaqualand, **South Africa**	van Dijk 1985; Smith 1986
	pipid	crater lake	diamond exploration site; **Zaire**	
Upper	*Saltenia ibanezi*	**argillaceous sandstone**	Almenia, Salta; **Argentina**	Reig 1959; Parodi-Bustos *et al.* 1960; Ibanez 1960; Baez 1983
Upper	ranid; 2 pipids cf. *Xenopus* r+;*	continental-marine margin	d'In Beceten, near Tahoua; **S Niber**	de Broin *et al* 1974
Lower	*Thoraciliacus; Cordicephalus* Shomronella jordanica	**lacustrine silt, volcanic terrain laminated shales,**	Makhtesh Ramon; **Israel** Shomron; **Israel**	Nevo 1956, 1968 Estes *et al* 1978

** = *Silurana* * = *Silurana* # cf. *Xenopus muelleri* + cf. *Hymenochirus* *+ cf. *Silurana & Hymenochirus*

TABLE 1.

Fossil Lissamphibia in Africa, and related fossils in South America and Israel.

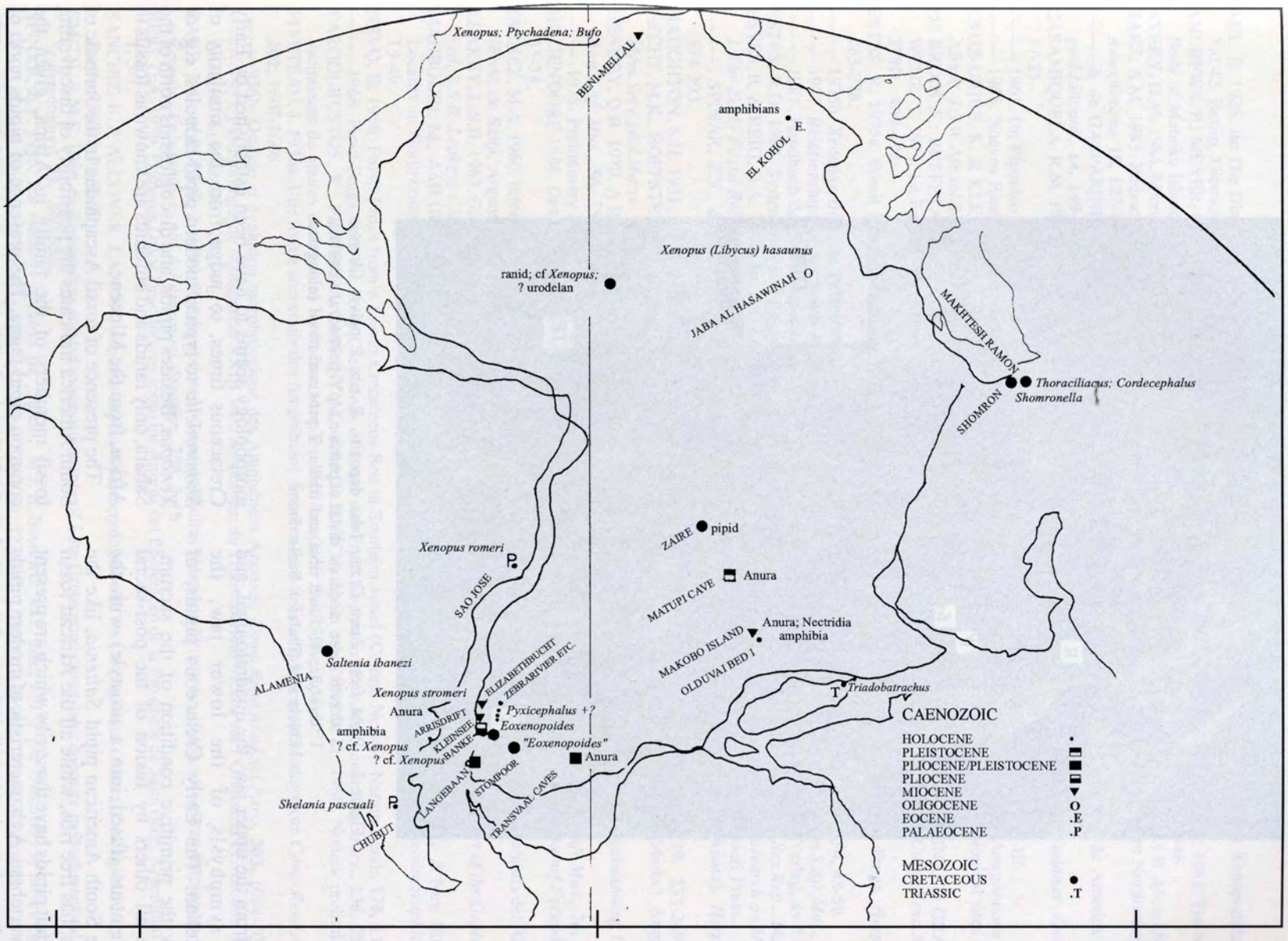

Figure 1. Fossil Lissamphibia in Africa, and related fossils in South America and Israel. Localities are labelled obliquely in Upper Case; the Taxa at the sites are indicated horizontally next to the sites or, where necessary, next to the site labels. Note that there are two sites near Elizabethbucht, and therefore two separate taxon labels. The geological ages of the fossils are indicated by the symbols in the key.

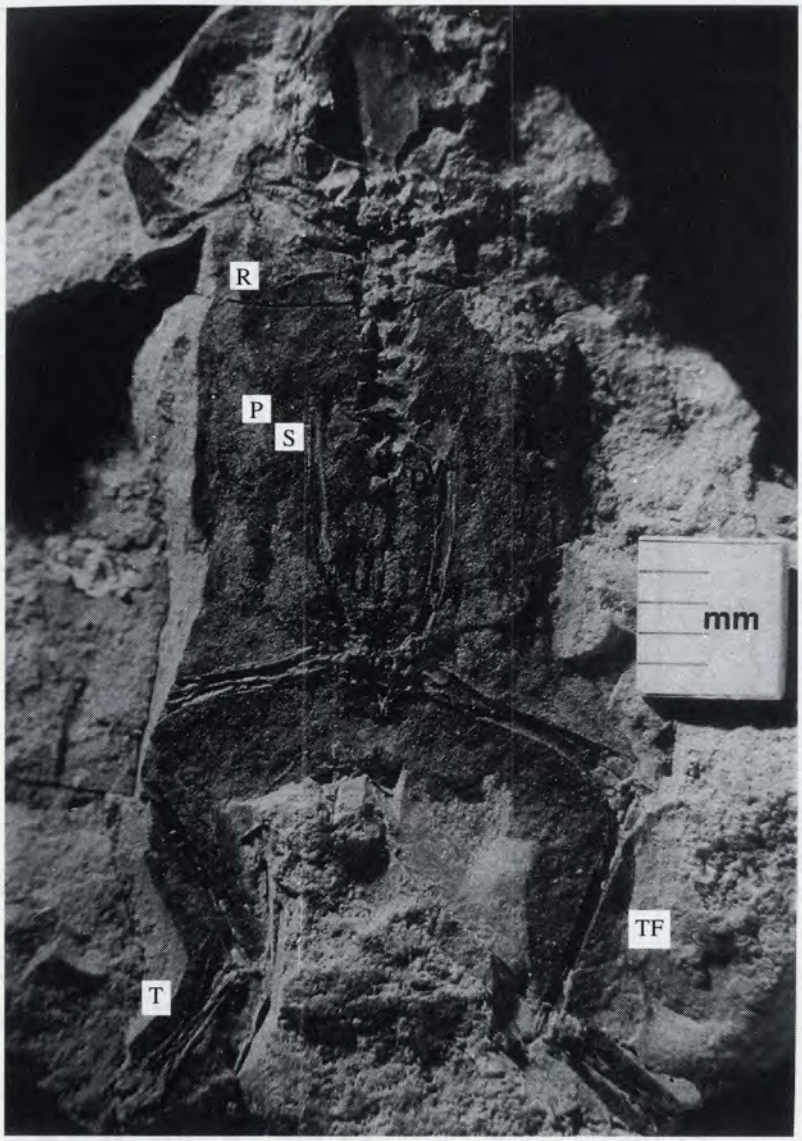

Figure 2. Pipid from Zaire Crater lake deposits. R rib; P pelvis (ilium); S sacrum (note moderate distal expansion); pV postsacral vertebra; U urostyle; TF fused tibia and fibula; T proximal tarsal (elongated tibiale and fibulare). Scale: 5mm.

an element from the upper jaw, the quadratojugal, and from the symphysis of the lower jaw, the Mentomeckelian. The Early Cretaceous pipids, of Israel, show the primitive condition of the sacrum, modified in all others by fusion of the post-sacral vertebral elements (fused into a urostyle) with the sacrum. The South American pipid *Saltenia*, like the Israel pipids, has free ribs, while all the African fossil and living adult pipids have those ribs which are present fused to the vertebrae. A characteristic of modern pipids of both South America and Africa, observed in some fossils, is an expanded sacrum, with straight parallel lateral edges, along which the parallel anterior projections of the ilia can slide; this was discovered in the living genera *Pipá* (South American) and *Xenopus* (African) by Hilgendorf in 1884, to which work no-one seems to have referred, before or after the rediscovery of the phenomenon (in 1960). The ilia may project well anterior to the sacrum. A characteristic pipid tadpole morphology seems to have been established by Early Cretaceous times, to judge from the similarity of *Shomronella* to typical modern pipid tadpoles, e.g. of *Xenopus*. Besides pipids, and discoglossids north of the Sahara, only ranids and bufonids are known as fossils in Africa, from the Miocene.

The presence of fossil Ascaphidae in the Jurassic of South America indicates the possibility of discovering fossil members of the family in Africa, given the common pipid fauna. The presence of pipids north of the Sahara in the Miocene suggests that elements of the European fauna, such as those found in North Africa, may also have extended south of the Sahara.

That fossil anuran material in Africa is available for study, is illustrated in the Table and Map. An indication of abundance at one site may be deduced from the recorded presence of "Amphibia" at 22 of 23 sampling spits at Zebrarivier Cave (Avery 1984). A fossil awaiting description is illustrated in Figure 2.

REFERENCES

AHL, E. 1926. **In:** Die Diamantenwüste Südwest-Afrikas (bearb. KAISER, E.).Band II 12. Anura; Aglossa Xenopodidae pp. 141-142 Taf.42. Berlin, Dietrich Reimer, 2 Bände.

ANDREWS, P.; MEYER, G.E.; PILBEAM, D.R.; VAN COUVERING, J.A.; & VAN COUVERING, J.A.H. 1981. The Miocene Fossil Beds of Maboko Island, Kenya: Geology, Age, Taphonomy and Palaeontology. *J.human Evol.*, **10,** 35-48.

AVERY, D.M. 1984. Micromammals and environmental change at Zebrarivier Cave, Central Namibia. *Jour.S.W.Afr.sci.Soc.*, **38,** 79-86.

BAEZ, A.M. 1983. Redescription and Relationships of *Saltenia ibanezi*, A Late Cretaceous Pipid Frog from Northwestern Argentina. *Ameghiniana* **18,** 127-154.

---------& de GASPARINI, Z.B. 1977. Origenes y Evolucion de los Anfibios y Reptiles del Cenozoico de America del Sur. *Acta geol.Lilloana,* **14,** 149-232.

CASAMIQUELA, R.M. 1960. Datos Preliminares Sobre un Pipoideo Fósil de Patagonia. *Actas Trab.Congr.Sudamer. Zool.*, **1** *(Secc. V):* 17-21.

--------- 1961. Un Pipoideo fosil de Patagonia. Rev.Mus. La Plata (Nueva Ser.) *Paleont.* **4,** 71-123 Lams. I-III.

--------- 1965. Nuevos Ejemplares de Shelania pascuali (Anura, Pipoidea) del Eoterciario de la Patagonia. *Ameghiniana* **4,** 41-51.

CRUZ-URIBE, K. & KLEIN, R.G. 1983. Faunal remains from some Middle and Later Stone Age archaeological sites in South West Africa. *J.S.W.Afr.sci.Soc.*, **36/37,** 91-114.

DE BROIN, F.; BUFFETAUT, E.; KOENIGUER, J-C.; RAGE, J-C.; RUSSELL, D.; TAQUET, P.; VERGNAUD-GRAZZINI, C.; & WENZ, S. 1974. La Faune de Vertébrés continentaux du gisement d'In Beceten (Sénonien du Niger). *Comp.Rend.Acad.Sci.Paris,* **279D,** 469-472.

ESTES, R. 1975a. Fossil Xenopus from the Paleocene of South America and the Zoogeography of Pipid Frogs. *Herpetologica,* **31,** 263-278.

--------- 1975b. *Xenopus* from the Palaeocene of Brazil and its zoogeographic importance. *Nature Lond.*, **254,** 48-50.

--------- 1977. Relationships of the South African Fossil Frog Eoxenopoides reuningi (Anura, Pipidae). *Ann.S.Afr.Mus.*, **73,** 49-80.

--------- 1981. Handbuch der Paläoherpetologie. Part 2. Gymnophiona, Caudata. Stuttgart, Gustav Fischer Verlag, xv 115pp.

ESTES, R.D. 1982. Systematics and Paleography of Some Fossil Salamanders and Frogs. *Nat.Geogr.Soc.Res.Rep.*, **14,** 191-210.

ESTES, R. & REIG, O.A. 1973. **In:** *(ed. J.L. Vial).Evolutionary Biology of the Anurans – Contemporary Research on Major Problems 1 The Early Fossil Record of Frogs – A Review of the Evidence 11-63.* Columbia, University of Missouri Press.

---------, SPINAR, Z.V., & NEVO, E. 1978. Early Cretaceous Pipid Tadpoles From Israel (Amphibia: Anura). *Herpetologica,* **34,** 374-393.

HAUGHTON, S.H. 1931. On a Collection of Fossil Frogs from the Clays at Banke. *Trans.roy.Soc.S.Afr.* **19,** 233-249.

HECHT, M.K., HOFFSTETTER, R., & VERGNAUD, C. 1961. Le gisement de Vertébrés de Beni-Mellal (Maroc). Amphibiens. *Notes Mém.Serv.géol.Maroc.* 155: 103.

HENDEY, Q.B. 1970. A Review of the Geology and Palaeontology of the Plio/Pleistocene Deposits at Langebaanweg, Cape Province. *Ann.S.Afr.Mus.*, **56,** 75-113.

--------- 1978. Preliminary Report on the Miocene Vertebrates from Arrisdrift, South West Africa. *Ann.S.Afr.Mus.*, **76.** 1-41.

HILGENDORF 1884. Das Ileo-Sakral-Gelenk der zungenlosen Frösche (Pipa, Dactylethra). *Sitz.-ber.Ges.naturf.Freunde Berlin* 1884. 35-38.

IBANEZ, M.A. 1960. Informe Preliminar sobre el Hallazgo de Anuros en las "Areniscas Inferiores" de la Quebrada del Rio las Conchas, (Prov. de Salta, Argentina). *Acta geol.Lilloana,* **3,** 173-180.

LEAKEY, L.S.B. 1967. *Olduvai Gorge 1951-1961.* **In:** Leakey L .S.B., Ed., *Volume I A Preliminary Report of the Geology and Fauna (ed. L.S.B. Leakey) Chapter V Non-Mammalian Fauna 70-72.* Cambridge, University Press.

MAHBOUBI, M., AMEUR, R., CROCHET, J.Y., JAEGER, J.J. 1986. El Kohol (Saharan Atlas, Algeria): A New Eocene Mammal Locality in Northwestern Africa Stratigraphical, Phylogenetic and Palaeobiogeographical Data. *Palaeontographica Abt.* A **192:** 15-49.

NEVO, E. 1956. Fossil Frogs from a Lower Cretaceous Bed in Southern Israel (Central Negev). Nature Lond., **178,** 1191-1192.

--------- 1968. Pipid Frogs from the Early Cretaceous of Israel and Pipid Evolution. *Bull.Mus.comp.Zool.Harv,.* **136,** 255-319.

PARODI-BUSTOS, R.; FIGUEROA CAPRINI, M.; KRAGLIEVICH, J.; & del CORRO, G. 1960. Noticia preliminar acerca del yacimiento de anuros extinguidos de Puente Morales. *Rev.Fac.Cienc.Nat. Salta,* **1,** 1-20.

PIVETEAU, J. 1936a. Une forme ancestrale des Amphibiens Anoures dans le Trias inférieur de Madagascar. *Comp.Rend.Acad.Sci.Paris,* **202,** 1607-1608.

---------936b. Origine et évolution morphologique des Amphibiens Anoures. *Comp.Rend.Acad.Sci.Paris,* **203,** 1084-1086.

--------- 1937. Paléontologie de Madagascar XXIII. - Un Amphibien du Trias Inférieur – Essai sur l'Origine et l'Évolution des Amphibiens Anoures. *Ann.Paléont.,* **26,** 135-177.

RAGE, J.-C. & ROCEK, Z. 1989. Redescription of Triadobatrachus massinoti (Piveteau, 1936), an anuran amphibian from the Early Triassic. *Palaeontogr. Abt A Palaeozool.-Stratigr.*, **206,** 1-16.

REIG, O.A. 1959. Primeros Datos Descriptivos sobre los Anuros del Eocretáceo de la Provincia de Salta (Rep. Argentina). *Ameghiniana,* **1,** 3-7.

SANCHIZ, B. & ALCOVER, J.A. 1984. Algunos aspectos paleontologicos de los Discoglossus (Anura, Discoglossidae) norteafricanos. *Butlleti SCIH,* **9:** 46-51.

SMITH, R.M.S. 1986. Sedimentation and palaeoenvironments of Late Cretaceous crater-lake deposits in Bushmanland, South Africa. *Sedimentology,* **33,** 369-386.

SPINAR, Z.V. 1980. *The Geology of Libya* **In:** Salem, M.J. & Busrewil, M.T. Eds., *Vol. 1 The Discovery of a New Species of Pipid Frog (Anura, Pipidae) in the Oligocene of Central Libya pp. 327-348.* London, Academic Press, 3 volumes.

STROMER, E. 1926. *Die Diamantwüste Südwest-Afrikas (bearb. E. Kaiser) Band II XXI. Reste Land und Süsswasser bewohender Wirbeltiere aus den Diamantfeldern Deutsch- Südwestafrikas I Einleitung 107-110.* Berlin, Dietrich Reimer, 2 Bänden.

--------- 1931. Reste Süsswasser und Land bewohnender Wirbeltiere aus den Diamantfeldern Klein-Namaqualands (Südwestafrika). *Sitz.-ber.bayer.Akad.Wiss.*, 1931,17-47.

VAN DIJK, D.E. 1985. An addition to the fossil Anura of Southern Africa. *S.Afr.J.Sci.* **81,** 207-208.

--------- 1995. Fossil Anura of Southern Africa. *Madoqua* (in press).

NEER, W. van 1984. Faunal Remains From Matupi Cave, An Iron Age and Late Stone Age Site in Northeastern Zaïre. *Med.kon.Acad.Weten.Lett.sch.Kunst. Belg.*, **46,** 57-76.

VERGNAUD-GRAZZINI, C. 1966. Les Amphibiens du Miocène de Beni-Mellal. *Notes Serv.géol.Maroc.*, **27** (198), 43-75.

WATSON, V. 1993. Composition of the Swartkrans bone accumulations, in terms of skeletal parts and animals represented. *Transv.Mus.Monographs,* **8,** 35-73.