FOSSIL RANIDS from MIocene DEPOSITS of CENTRAL ANATOLIA

ORTA ANADOLU’NUN (TÜRKİYE) MİYOSEN FOSİL RANİDLERİ

Neriman RÜCKERT-ÜLKÜMEN
Bavarian State Collection of Paleontology and Geology, Richard-Wagner-Strasse 10, 80333 München, Germany

ABSTRACT: Two findings of fossil specimens of the genus Rana are described, both from Miocene (Tertiary) freshwater deposits from Turkey: Rana barani RÜCKERT-ÜLKÜMEN from Beşkonak Köyü near Kızılehamam and Rana sp. 1 from Alpagut-Dodurga near Çorum Central Anatolia. The anatomy of the skull of Rana barani proves a close taxonomical relationship with Rana ridibunda. Rana sp. 1 is closely related to Rana temporaria. Comparisons with the fossil species Rana strausi ŞPINAR underline the taxonomical status of the described fossil species Rana barani and Rana sp. 1.

Key words: Fossil Ranids, Miocene, Central Anatolia

ÖZ: Orta Anadolu’ nun iki ayrı bölgesindeki Miyosen yaşlı tabakalarında bulunan Rana cinsi üzerine olan bir çığ sıradır: Birincisi Kızılehamam’ in Beşkonak köyünden Rana barani RÜCKERT-ÜLKÜMEN, 1980; ikincisi Çorum’un Alpagut-Dodurga bölgesindeki Rana sp. 1. Taksonomik olarak Rana barani kafatası zamanı dansında bulunduğu, Rana ridibunda’ ya, Rana sp. 1 ise Rana temporaria grubuna girer. Ayrıca bir fosil türü olan Rana strausi ŞPINAR la mukayesesi de Türkiye’ yi temsil eden her iki Rana cinsinin farklı türler olduğu teşhis edilmiştir.

Anahtar kelimeler: Fosil Ranidler, Miyosen, Orta Anadolu

INTRODUCTION

The fossil material described in the present paper was given to the author by Prof. Dr. Ö. KAYA and Dipl. Geol. Ü. GÜNDÖGAN both Dokuz Eylül University, İzmir. It has been found in Alpagut-Dodurga (Fig. 1), a locality 30 km NNW of Çorum (NE of Ankara, Turkey).

The fishlayer, 260 m thick, from Late Oligocene (?)- to Miocene is composed of a sequence of laminated marl, siltstone and carbonate, and subordinated lignite (Fig. 2). The here described frog originate from a finely laminated siltstone including a carbonate layer, 60 m above the basis, little above the lignite layer.

The holotype of Rana barani RÜCKERT-ÜLKÜMEN, 1980 is used here for comparison, a species that has been described from the Late Miocene of Beşkonak Köyü at Kızılehamam (PAICHLER et al., 1978 and RÜCKERT-ÜLKÜMEN, 1995). The original description will be extended here and differences will be worked out between the species of Rana barani and Rana sp. 1 that is firstly discovered. Freshwater fishes as well as the stratigraphical situation of the deposits of Çorum are described in detail in RÜCKERT-ÜLKÜMEN (1998).

The recent species of Rana are grouped within two monophyla, The Rana ridibunda-group (green or water frogs, adapted to aquatic life) and the Rana temporaria-group (brown frogs, adapted to a more terrestrial life) (GÜNTHER, 1996).

In the present study, the morphological differences of the squamosum and ilium bones of several fossil and Recent Rana-species will be compared and the position of Rana barani and Rana sp. 1 within the genus will be discussed.

LOCATION of ALPAGUT-DODURGA, ÇORUM

The Oligo-?(?) Miocene fish-and froglayers, which provide the material for this paper, are at Alpagut-Dodurga, approx. 30 km NNW of Çorum (Middle Anatolia, Turkey) (Fig. 1). The sequence, about 260 m thick, lays discordantly over a mixed package of Eocene age, the latter consisting of sandstone-siltstone sequences which were penetrated by a basalt pipe. Eight micropalaeontological samples have been taken and analysed from the whole sequence. The remainder of sample 1, a green-brown, rough chunked siltstone, consists of quartz, pyrite, limonite, and some glauconite, without any fossils. Most likely, the glauconite grains represent redepotted Eocene sediments. The samples 2 to 8 consist exclusively of freshwater deposits, yielding only pharyngeal teeth of several genera of Cyprinidae. A fine, laminated siltstone between the microsamples 3 and 4 supplied small fishes. Furthermore, this layer yielded remains of swamp plants (roots of Poaceae?), indicating a fossil rootzone.
10 to 20 m deeper, some lignite prove temporary decrease of the water level and the existence of fens and swamps. Other evidences of brackish or marine parenthesis apart from the above mentioned glauconite were not found.

**Taxonomy**

Class: Amphibia  
Order: Anura  
Family: Ranidae GRAY, 1825  
Genus: Rana LINNAEUS, 1758  
Typespecies: Rana temporaria LINNAEUS, 1758  
*K. barani RÜCKERT-ÜLKÜMEN, 1980*  
(Plate I-Figures 1-3; Figures 3-6; Table 1)  
1980 Rana barani n. sp. - RÜCKERT-ÜLKÜMEN,  
Fossile Fische und Frösche aus dem höheren Miozän  
von Zentral-Anatolien.: 1-14, 9 Taf.

Material: one complete specimen, holotype BSP Inv.-Nr. 1980 X 1.  
Locus typicus: Kızılcakhamam, Beşkonak Köyü, Ankara, Turkey.  
Stratum typicum: Late Miocene.

Description: This specimen lies on the dorsal side. The head is oval and flat, 22 mm long and at maximum 25 mm wide. The relationship width/length is 1.136. Length of trunk is 61 mm. The front of the rostrum is round. The praemaxillare is strong with a short pars facialis and a broad pars dentalis. The right praemaxillare has 11 recurved teeth. Two third of the maxillare carry 31-32 fine and thin teeth. The quadratojugale (or quadratomaxillare) is strong and has one third of the length of the maxillare. It connects the distal end of the laterocaudal branch of the squamosum and the distal end of the maxillare. In front of the frontale are two anteriorly pointed nasale...
The determination of Recent ranids follows more or less exclusively the external anatomy and the ethological characteristics, while palaeontological classification must be based on osteological characteristics. The here described pigmentation is a rare case of preservation of a soft body character, providing additional information of taxonomic value.

Diagnosis: a medium-sized frog with the following characters:
1. Compact body
2. Length of trunk is 61 mm. Length of skull is 22 mm and fits in the length of trunk 2.73 and in the whole body 5.95 times.
3. The frontale has a very fine sutura medialis, the frontparietale is broad and crescent-shaped.
4. The praemaxillare and maxillare have complete teeth.
5. The quadrategill is long and strong.
6. Small squamosa are at the left and right ventral side of the pterogoid, ramus posterolateralis is longer than ramus zygomatus.
7. The spine consists of 9 short vertebrae.
8. Os coccygis is shorter and more slender than the ilium.
9. Sacral vertebra forms an angle of 60° to 65° with the os coccygis.
10. The ilium, ischium and femur are partly covered with quadrangular pigment marks.
11. The stretched hind leg reaches only the frontal end of the eye sockets.

Remark: The bones of the front legs are not in the original place, being pushed to the front during embedding. The humerus lies dorsal and owns a strong impressio olecranon. The humerus has a direct contact to scapula, coracoid and clavicula.

The scapula is only visible at the left front leg, being 7 mm long and 1 to 2 mm wide. The two ends of the clavicles are rounded. The humerus of the right front leg has a length of 14 mm, and is followed by the ulna and radius (10 mm long and 3 mm wide). The first carpale is small and round, the second a bit larger. The second and third phalanges are conjuncted with the second carpale. The third carpale is as small and round as the first one. The first phalange has only one bone which is developed rudimentarily. The second, third and forth phalange consist of three bones, the fifth is the longest with four bones (Fig. 6). The Ilium, ischium and femur are partly covered with quadrangular pigment marks (Plate I-Fig. 3).
Figure 4 The ilium of different *Rana* species, fossil and Recent

*Şekil 4* Fosil ve güncel farklı *Rana* türlerinin iliumu

a) *Rana barani*, a’) *Rana esculanta*, a”’) *Rana ridibunda*, b) *Rana sp. 1*, b’) *Rana temporaria*, c) *Rana strausi* (after ŞPINAR).

Ci Crista ossisi ili, Co Collum ossis ili, Pa Pars ascendens ossis ili, Pci Pars cylindriformis ossis ili, Pd Pars descendens ossis ili.

*Rana sp. 1* (Plate II-Figures 1-2; Figures 3-4; Table 1)

Material: One complete specimen, BSP Inv.-Nr. 1980 X 976 a, b, panel and antipanel.

Locus typicus: Alpagut-Dodurga near Çorum, province Çorum, Central-Anatolia, Turkey.

Stratum typicum: Fish layer, Early to Middle Miocene.

Description: A medium-sized frog in dorsal view. The front and hind legs of the right and left carpal region and the distal phalanges are missing. The head is 17 mm long and at maximum 22 mm wide, length of trunk 60 mm. Head size fits in trunk length 3.5 times. The praemaxillare and maxillare have short, acuminate teeth; however, the poor conservation of the jaw-bone makes it impossible to distinguish the exact number of the teeth. The praemaxillare and maxillare have fine, acuminate teeth. The shape of the septomaxillum is semicircular. The nasale is frontally tapering off and caudally of oval shape, reaching to the orbita (9 mm long and 5 mm wide). The ethmoid is small and frontally slightly rounded. *Rana* sp. 1 has slender and thin frontparietale, which are fused in the middle. They reach up to the narrow and small os squamosum. Beneath both frontparietale are two deeply pressed, broken prootica-bones. Above the prootica is the squamosum with a short ramus posterolateralis and also a robust but longer ramus zygomaticus (Fig.3 c). Only fragments are left of the exoccipitalia (Plate II-Fig. 1).

In contrast to the holotype of *Rana barani* the number of the vertebrae are easily to distinguish, due to the good preservation. The atlas is rhombical, the second vertebra has short but robust processi transversalia, 3rd and 4th vertebrae have broader and longer processi transversalia, those of the 5th to 8th vertebrae have shorter and smaller lateral processes. The 9th sacral vertebra forms an angle of 70° to 80° with the os coccygis. *Rana* sp. 1 has a robust os coccygis with a thick frontal joint and a total length of 22 mm. This os coccygis laterally owns a small crista coccygis. The length of the ilium is 22 mm and the pars cylindriformis ossis ili has a small crista ossis ili. The corpus ossis ili partly destroyed. The length of femur is 29 mm, tibia is 29 mm, tarsale (tibia fibulare) is 12 mm long (Plate II-Fig. 2). The tibia-fibula joint of the streched hind leg reaches the frontal end of mouth (Fig. 5b).

Remark: In the recent species *Rana cameranoi* BOULENGER, 1886, the tibia-fibula joint of the streched hind leg also reaches the frontal end of mouth. This species is known as a mountain frog, but was found in forestal pools near the Black Sea by EISELT, 1965 (BAŞOGLU & ÖZETLI, 1973).

Diagnosis: a medium-sized frog with the following characters:

1. The head relatively small and narrow.
2. Length of trunk is 60 mm. Length of skull is 17 mm and fits in the length of trunk 3.5 and in the whole body 7.94 times.
3. The frontparietale is thin and slender.
4. The praemaxillare and maxillare complete with acuminate teeth.
5. The quadratojugale is short and strong.
6. The squamosum is robust, with small ramus posterolateralis and ramus zygomaticus.
7. The spine consists of 9 short vertebrae, with robust processi transversalia.
8. Os coccygis and ilia approximately at the same size.
9. Sacral vertebra forms an angle of 70° to 80° with the os coccygis.
10. The femur, ilium and os coccygis are robust.
11. The tibia-fibula joint of the streched hind leg reaches the frontal end of mouth.

I think that this must be a new species. But, I could not describe it as a new species due to absence of sufficient data. For the present, I accepted it as *Rana* sp. 1.
Comparisons

*Rana* sp. 1 (Alpagut-Dodurga) in comparison with *Rana barani* (Beşkonak)

While the skeleton of the holotype of *Rana barani* was found with preserved parts of the soft body in the diatom layers of Beşkonak, the fossil of *Rana* sp.1 of Alpagut-Dodurga shows pure osteological preservation. The animal is squeezed, with the dorsal side exposed.

**Figure 5** *Rana barani* RÜCKERT-ÜLKÜMEN from Beşkonak and *Rana* sp. 1 from Alpagut-Dodurga:

- a) *Rana barani* RÜCKERT-ÜLKÜMEN: the tibia-fibula joint of the stretched hind leg reaches the frontal end of the eye socket.
- b) *Rana* sp. 1: the tibia-fibula joint of the stretched hind leg reaches the frontal end of mouth. Scale 1/1.

In comparison with the holotype of *Rana barani*, *Rana* sp. 1 it is a little bit smaller, almost missing all foot bones, but with a well-preserved head. The latter is more triangular and more pointed than in *Rana barani*. The hind legs of the *Rana* sp. 1 are longer than in *R. barani*. The holotype of *Rana barani* misses the front and back foot bones, also some important characteristics of the other bones are not visible (Fig. 5 a, b; Table 1).

**Figure 6** *Rana barani* RÜCKERT-ÜLKÜMEN 1980 holotype:


**Comparisons of *Rana barani* with other species**

The ramus zygomaticus and ramus posterolateralis of the squamosum of *Rana barani* (Fig. 3 b) are thinner and shorter as those of *Rana strausi* (fossil, Fig. 3 a) and *Rana ridibunda* (recent, Fig. 3 d).

**Taxonomical position of *Rana barani* and *Rana* sp.1**

*Rana barani* belongs to the *ridibunda*-group (water frogs) because of the following osteological characters: robust frontoparietale, stout corpus ossis illi, relatively short hind legs (BÖHME 1977).

*Rana* sp.1 belongs to the *temporaria*-group (brown frogs) because of the following osteological characters: slender, thin frontoparietale, long hind legs (BÖHME 1977).
The ilia of *Rana barani* (Fig 4 a) have a firmer pars cylindriformis ossis ilii and a very thin crista ossis ilii. The area between pars descendes ossis ilii and the ventral pars ascendens ossis ilii is arched. The ilia differ from those of *Rana esculenta* (Fig. 4 a’) and *Rana ridibunda* (Fig. 4 a’’) in the thin crista ossis ilii and the arched ventral margin.

**Table 1** Dimensions (in mm) of *Rana* sp.1 from Alpagut-Dodurga in comparison with the holotype of *Rana barani* from Beshkonak.

<table>
<thead>
<tr>
<th></th>
<th>Rana sp. 1</th>
<th>Rana barani</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collection number</td>
<td>BSP 1980 X 976 a,b</td>
<td>BSP 1980 X 1 (holotype)</td>
</tr>
<tr>
<td>Location</td>
<td>Alpagut-Dodurga</td>
<td>Beshkonak</td>
</tr>
<tr>
<td>Length of trunk</td>
<td>60</td>
<td>61</td>
</tr>
<tr>
<td>Length of head</td>
<td>17</td>
<td>22</td>
</tr>
<tr>
<td>Ulna + Radius</td>
<td>13</td>
<td>10</td>
</tr>
<tr>
<td>Humerus</td>
<td>11</td>
<td>14</td>
</tr>
<tr>
<td>Coracoid</td>
<td>10</td>
<td>7</td>
</tr>
<tr>
<td>Femur</td>
<td>29</td>
<td>22</td>
</tr>
<tr>
<td>Tibia</td>
<td>29</td>
<td>26</td>
</tr>
<tr>
<td>Tarsale (Tibia)</td>
<td>12</td>
<td>10</td>
</tr>
<tr>
<td>Tarsale (Fibula)</td>
<td>12</td>
<td>10</td>
</tr>
<tr>
<td>Illium</td>
<td>22</td>
<td>22</td>
</tr>
<tr>
<td>Os coccygis</td>
<td>22</td>
<td>20</td>
</tr>
</tbody>
</table>

**Comparisons of Rana sp. 1 with other species**

The ramus retrozygomaticus and ramus posterolateralis of the squamosum of *Rana* sp. 1 from Çorum (Fig. 3 c) are thicker and shorter as those of *Rana temporaria* (Recent, Fig. 3 e) and *Rana strausi* (fossil, Fig. 3 a).

*Rana* sp. 1 (Fig 4 b) has a stronger ilium than *Rana temporaria* (Fig 4 b’), also a broader crista ossis ilii and a stronger pars cylindriformis ossis ilii. It shows a big pars ascendens ossis ilii and a protruding, large pars descendens ossis ilii between which the ventral margin is slightly curved inwards. In *Rana temporaria*, the ventral ilium shows a completely different outline (narrower and pointed), in *Rana strausi*, the ilium as a whole is much broader and more stout than in *Rana sp.1*.

**Discussion**

The Early Tertiary freshwater fauna of Beshkonak is known for more than 20 years (PAICHELER et al., 1978). Four different groups of amphibians have been discovered here: waterfrogs of the genus *Rana*, spadefoot toads of the genus *Pelobates*, also some unidentified salamanders and newts. Fishes are represented by Cyprinids of the genera *Leuciscus*, *Barbus*, *Tinca* and *Rutilus* (RÜCKERT-ÜLKÜMEN, 1995).

The slightly older deposits of Alpagut-Dodurga are situated only 200 km NE of Beshkonak, now reveal a comparable fish and frog fauna with *Rana*, *Leuciscus* and *Barbus*. However, these two comparable fossil assemblages originate from petrologically different sediment: The Beshkonak fauna descent from diatome layers and the Alpagut-fauna is embedded in finely laminated siltstones with thin horizons of carbonate.

Recent faunal assemblages of standing water bodies of the Northwest of the Anatolian plains still show similarities to the here described Tertiary amphibian and fish faunas: *Rana*, *Pelobates* and *Triturus* are occurring here together with the fish genera *Tinca* and *Rutilus* (Başoğlu, M. & Öz, N. 1973).

**Status and relationship of Rana barani**

In spite of a long history of taxonomic work on the recent palaearctic water frogs, their taxonomy is still doubtful. Many species of this group cannot be distinguished morphologically, and the fact that the rare case of hybridogenesis occurs within this genus makes the application of a taxonomy based on external anatomy even more inappropriate (GUENTER, 1990). Thus, the actual taxonomy of Recent water frogs is mainly based upon cytogenetics (e.g. HOTZ et al., 1987, BEERLI et al., 1994), bioacoustical methods (e.g. SCHNEIDER & SINSCH, 1992, 1999, SCHNEIDER et al. 1984, 1992) and finally biometrical procedures (SINSCH & SCHNEIDER, 1999), all of them not being applicable to fossil water frogs. The doubtful system of Recent water frogs prevents an adequate taxonomical analysis of the fossil *Rana* species (SANCHIZ, 1998). SANCHIZ (1998), therefore...
designates *Rana barani* (among others) as nomen dubium; however, he refers this species to the ridibunda-group.

From the Eastern part of the Mediterranean, at least six Recent water frog species (*Rana epeirotica*, *R. sqüiperica*, *R. bedriagae*, *R. cretensis*, *R. cerigensis* and *R. ridibunda*) are known. At least two of them (*R. bedriagae* and *R. ridibunda*) are reported from Turkey (Schneider & Sinsch, 1999; Sinsch & Schneider, 1999). Another taxa of uncertain validity (*Rana ridibunda caralitana*) was described from the Southwest of central Anatolia (Arikán, 1988, Atatürk et al. 1990).


**References**


Yayı na Geliş – Received : 21.05.03
Yayı na Kabul- Accepted : 15.07.03
Plate I Rana barani RÜCKERT-ÜLKÜMEN 1980, holotype from Beşkonak (Kızılkahamam), Fe- BSP 1980 X 1
Fig. 1: details of head; Fig. 2: whole specimen with imprints of soft body; Fig. 3: Oc coccygis, ilium and ischium with pigmentation.

Levha I Rana barani RÜCKERT-ÜLKÜMEN 1980 holotip, Beşkonak (Kızılkahamam), Fe- BSP 1980 X 1
Şekil 1: Başın detayı; Şekil 2: Yumuşak dokulu gövdenin izi ile birlikte tüm görünüm; Şekil 3: Oc coccygis, ilium ve ischium ile pigmentler.

Plate II Rana sp. 1 BSP 1980 X 976 from Alpagut-Dodurga (Çorum)
Fig. 1: head with front extremities; Fig. 2: whole specimen.
FOSSIL RANIDS from MIOCENE DEPOSITS of CENTRAL ANATOLIA
ORTA ANADOLU' NUN (TÜRKİYE) Mİ YOSEN FOSİL RANI DLERİ

Levha II Rana sp.1 BSP 1980 X 976 Alpagut-Dodurga (Çorum)
Şekil 1 : Baş ve ön ayaklar; Şekil 2 : Tüm görünüm