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Holocene anurans from Caucasus

ZBYNEK ROCEK

Department of Paleontology, Geological Institute, Czechoslovak Academy of Sciences, Rozvojova 135, CS-165 00 Prague, Czech Republic

Abstract. -Holocene deposits of the Kudaro I Cave from the vicinity of Ertso Lake (South Ossetia, NW Caucasus) yielded, among others, rather numerous disarticulated anuran bones. Examination of this sample revealed that majority of this material belongs to the genus *Bufo* and to the family Ranidae. This generally corresponds to the composition of the contemporary anuran fauna of that region.

Key Words: Anura, Holocene, Caucasus, osteology.

Introduction

The material described in the present paper was recovered from the deposits of the cave Kudaro I. The cave is on the slope of Mt. Chasavalskaya (1600 m altitude), valley of Dzhordzhori River, in the vicinity of Ertso Lake, about 90 km NE from the town Kutaisi, South Ossetia, near Rachinsky ridge in the NW Caucasus (approx. 42° N, 43° W; see also Lyubin 1980a). The deposits are of the Holocene age (Lyubin 1980b).

First description of the anuran and reptile material from this cave was published by Darevsky (1980). His taxonomic assignments generally agree with those in the present paper. The material consists of isolated bones; anuran bones described in this paper are deposited in the Zoological Institute of the USSR Academy of Sciences, St. Petersburg, under collection numbers ZIL/EL/1 - ZIL/EL/185.

Anatomical terminology mostly follows that of Bolkay (1919) and Gaupp (1896). It should be noted that most of elements in the sample are postcranial bones and only few cranial bones are present. Fragmentary material bearing no diagnostic characters was excluded from the account below.

Systematic Paleontology

Bufo sp.

Material: Left scapula, ZIL/EL/7 (Fig. 7B). Probably also ZIL/EL/140 (Fig. 7A).

Description: The margin of the cavitas glenoidalis is elevated. Although both the pars acromialis and proc. glenoidalis are broken off it is obvious that there was a deep incision between them. There is a moderately prominent and rather pointed outgrowth on the margo anterior. Both scapulae are comparatively big elements corresponding by their size to the below described humeri and ilia.

Material: Humeri ZIL/EL/21 (Fig. 2B), ZIL/EL/25, ZIL/EL/55,

ZIL/EL/79, ZIL/EL/112 (Fig. 2A), ZIL/EL/132 (Fig. 2C), ZIL/EL/139, ZIL/EL/153, ZIL/EL/173.

These specimens (except for ZIL/EL/153 that includes also the most distal section of the crista ventralis) are preserved only as distal parts of the humerus. All of them are characteristic by conspicuous degree of development of the epicondylus medialis, the distal margin of which extends almost to the level of the distal margin of the caput humeri. Hence, there is a distinct notch between the both structures that can continue onto the dorsal surface of the distal section of the bone. On the ventral surface of the medial epicondylus one can discern an indistinct ridge running onto its distal surface. The lateral epicondylus is developed in lesser degree, extending laterally from the outline marked by the crista lateralis in some specimens (see Fig.

2A, B). The lateral surface of the caput humeri is worn away in larger specimens, so the ball is not complete. The whole distal end of the bone is bent ventrally; this is correspondingly reflected on its dorsal surface which is convex along its longitudinal axis. Some variation may be observed concerning the extent of the medial and lateral cristae which might be, however, assigned to secondary sex differences. This might be suggested also by small specimen ZIL/EL/55 which may represent an immature individual, and in which both cristae are lacking. On the other hand, all specimens have their crista medialis directed laterally, so its ventral surface meets the medial surface of the diaphysis almost perpendicularly. In ZIL/EL/25 and ZIL/EL/132 the margins of both cristae are rather undulated and thickened.

Discussion: These humeri (preserved only as distal sections) are morphologically closest to those of *Bufo*. In large with the determination of size-corresponding ilia. However, some (esp. smaller) humeri may fall into the variation range of the ranids, but the latter assignment lacks reliable foundation if only distal part of the bone is at the disposal. Discoglossids may be excluded because their medial and lateral cristae are confluent with the diaphysis, with no distinct border. The only fossil anuran that is of similar size as ZIL/EL/112 is *Latonia seyfredi* v. Mayer (= *Discoglossus giganteus* Wettstein-Westerheimb). However, its morphology and stratigraphic range are different (see e.g. Mlynarski, 1976, pl.I/4).

Material: Radioulnae ZIL/EL/43, ZIL/EL/62 (Fig. 8A), ZIL/EL/106 (Fig. 8B), ZIL/EL/116, ZIL/EL/120 (Fig. 8C), ZIL/EL/162.

Description: The margin of the olecranon rimming the articular cavity is formed either by calcified cartilage or ossified tissue lacking periostal bone. The border between the smooth periostal bone and rough surface rimming (and also covering) the articular cavity is distinctive. It seems that this most proximal part of the olecranon may be abraded in large specimens (e.g., ZIL/EL/62).

On the inner surface of the bone, close to the point where the margins of the articulation cavity of the olecranon and capitulum meet with one another, is a small but deep pit. Similar pit is lacking or not so deep in ranids, but regularly present in *Bufo*. It serves as a muscle insertion area and in some specimens may be doubled. The posterior margin of the bone (i.e., of its ulnar part) bears an indistinct crista in some specimens.

Material: Ilia ZIL/EL/41, ZIL/EL/66, ZIL/EL/75, ZIL/EL/94 (Fig. 4A), ZIL/EL/97, ZIL/EL/99 (Fig. 4B), ZIL/EL/124, ZIL/EL/129.

Description: The ala ossis ilii, if compared with the posterior part of the bone, are stout (ZIL/EL/94) or rather slender (ZIL/EL/99). Their dorsal margin is rounded, only in the mid-part it becomes an edge distinctly bent medially along its whole extent. In its anterior part, the ala is compressed dorsoventrally, ellipsoid in cross-section. On the medial surface of the ala, approximately at the level of the highest point of their arch, there is an orifice of the narrow horizontal canal coming onto the bone surface from the posterior. There is certain variation in the location and morphology of this canal - it may continue as a groove for a short distance anteriorwards, and the orifice may be located on the bottom of a horizontal depression developed below the above-mentioned edge. The depression may terminate anteriorly on the dorsal surface of the ala or, in some specimens (esp. smaller ones), the orifice is located posterior to the depression. The torus superior is extensive, with two to three tubercles continuing (except the most anterior one) as a short and low ridges laterally. The anterior-most tubercle continues as a short rounded ridge anteroventrally, onto the medial surface of the bone. ZIL/EL/124 (and some other ones) is much smaller but except for size its morphology corresponds in all principal features to that described above.

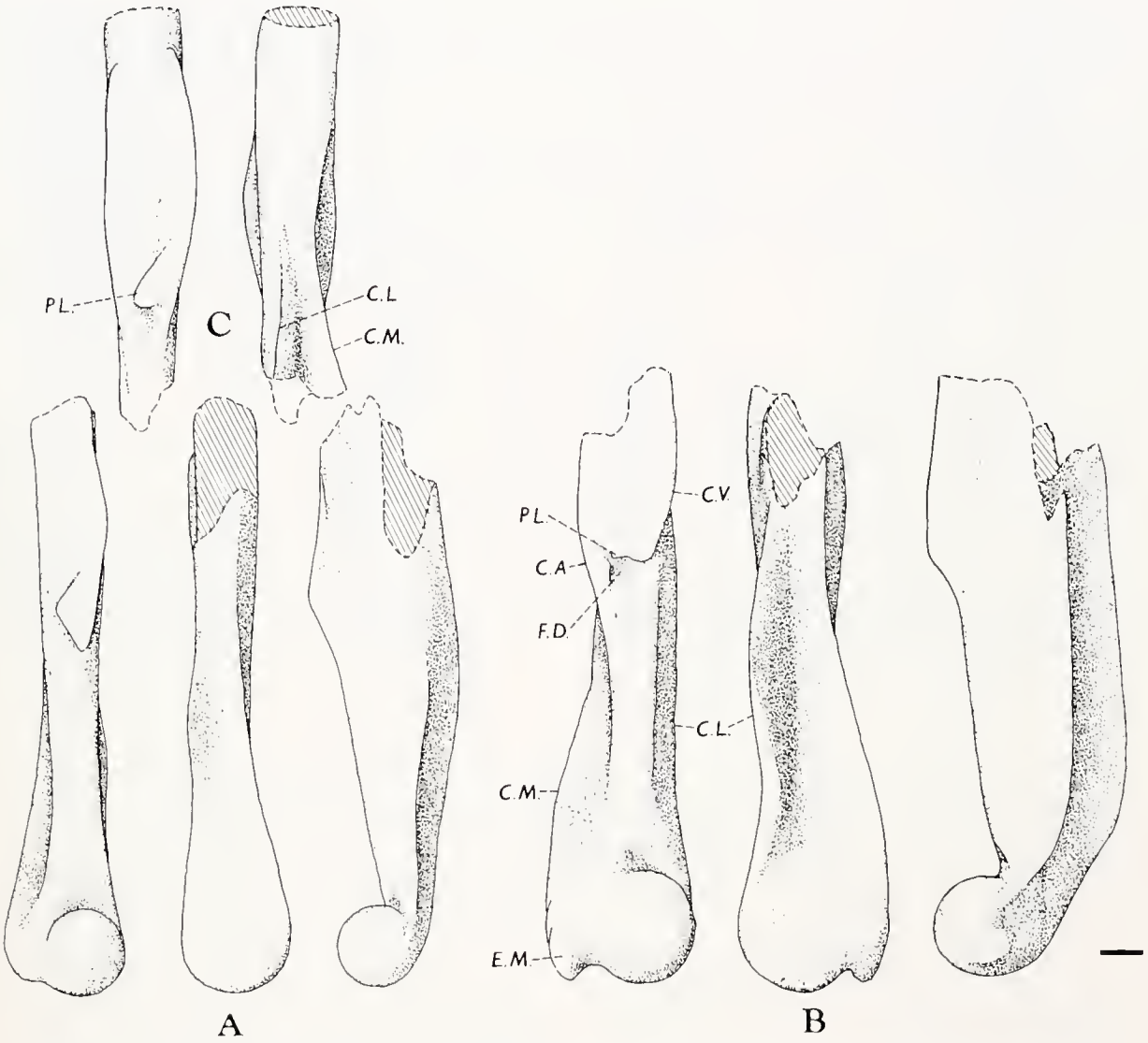

FIG.1. A- *Rana* sp. (ZIL/EL/148). Left humerus in ventral, dorsal and lateral views (from the left to right). B- *Rana* sp. (ZIL/EL/151). Left humerus in ventral, dorsal and lateral view (from the left to right). C- *Rana* sp. (ZIL/EL/74). Ventral (left) and dorsal (right) view of the proximal section of theright humerus (drawing reversed for comparison). Bar equals 1mm. Abbreviations: C. A. - crista adventiva; C.L. - crista lateralis; C. M. - crista medialis; C. V. - crista ventralis; E. M. - epicondylus medialis; F. D. - fossula dividens; P. L. -processus lingualis.

Discussion: The shape of the ilium corresponds to that in contemporary *Bufo bufo* and *B. viridis*. The only difference is that in both latter forms the longitudinal depression on the medial surface of the ala is developed in much lesser degree (due to lesser extent of the edge). It should also be noted that the orifice of the mentioned canal on the medial surface of the bone displays certain variation in contemporary forms (the orifice may be doubled, and the differences in this respect may be found also between the left and right ilium of a single individual). The same seems to hold for fossil material. Size differences may be ascribed either to interspecific variation or to differences between both sexes (the latter may reach quite a high degree in some contemporary representatives of the genus *Bufo*.

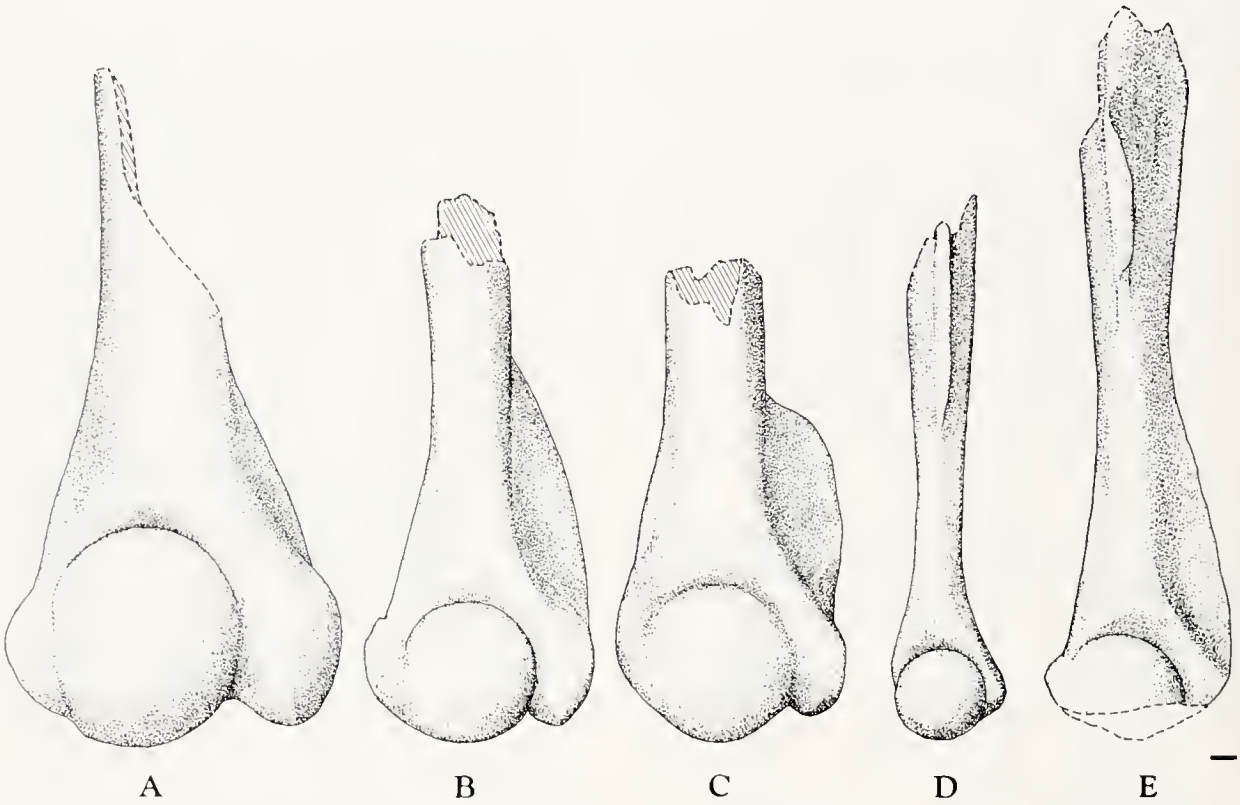

FIG. 2. A- *Bufo* sp. Right humerus (ZIL/EL/112). B- *Bufo* sp. Right humerus (ZIL/EL/21). C- *Bufo* sp. Left humerus, drawing reversed for comparison (ZIL/EL/132). D- Ranidae indet. Right humerus (ZIL/EL/150). E- Ranidae indet. Right humerus (ZIL/EL/110). Bar is 1 mm.

Rana sp.

Material: Humeri ZIL/EL/56, ZIL/EL/74 (Fig. 1C), ZIL/EL/83, ZIL/EL/128, ZIL/EL/148 (Fig. 1A), ZIL/EL/151 (Fig. 1B), ZIL/EL/179.

Description: The crista ventralis and crista adventiva delimit a wide, shallow and rather longitudinal depression for muscle insertion. The latter crista may be developed to various degree, whereas the crista ventralis is well developed in nearly all individuals, with a distinctive lingual process (only in ZIL/EL/128 this process is poorly developed, and the crista ventralis continues distally as a gradually lowering ridge). The crista ventralis has a hollow inside its free margin; consequently, it is thinner along its attachment to the diaphysis. This is manifested externally by grooves along the insertion of the crista, on either side. The crista lateralis and medialis are directed dorsally, forming thus a longitudinal groove on the dorsal surface of the bone. The proc. lingularis and the outgrowth produced by the crista adventiva may form together a roof over the fossula dividens; this nearly results in a canal. The caput humeri is well prominent ventrally (clearly seen in lateral aspect). Although the distal part of the bone is straight, the crista medialis and lateralis make it seemingly "S" shaped. Lateral epicondylus is entirely absent. Other features may be seen in Fig. 1B.

Some variation may be observed, mainly in the degree of development of the lingual process and in the extent of the medial and lateral cristae, as well as of the crista adventiva.

Anatomical notes: As may be deduced from the condition in *Rana esculenta* (Gaupp, 1896) the depression between the crista ventralis and adventiva could serve as an area of insertion for three heads of the

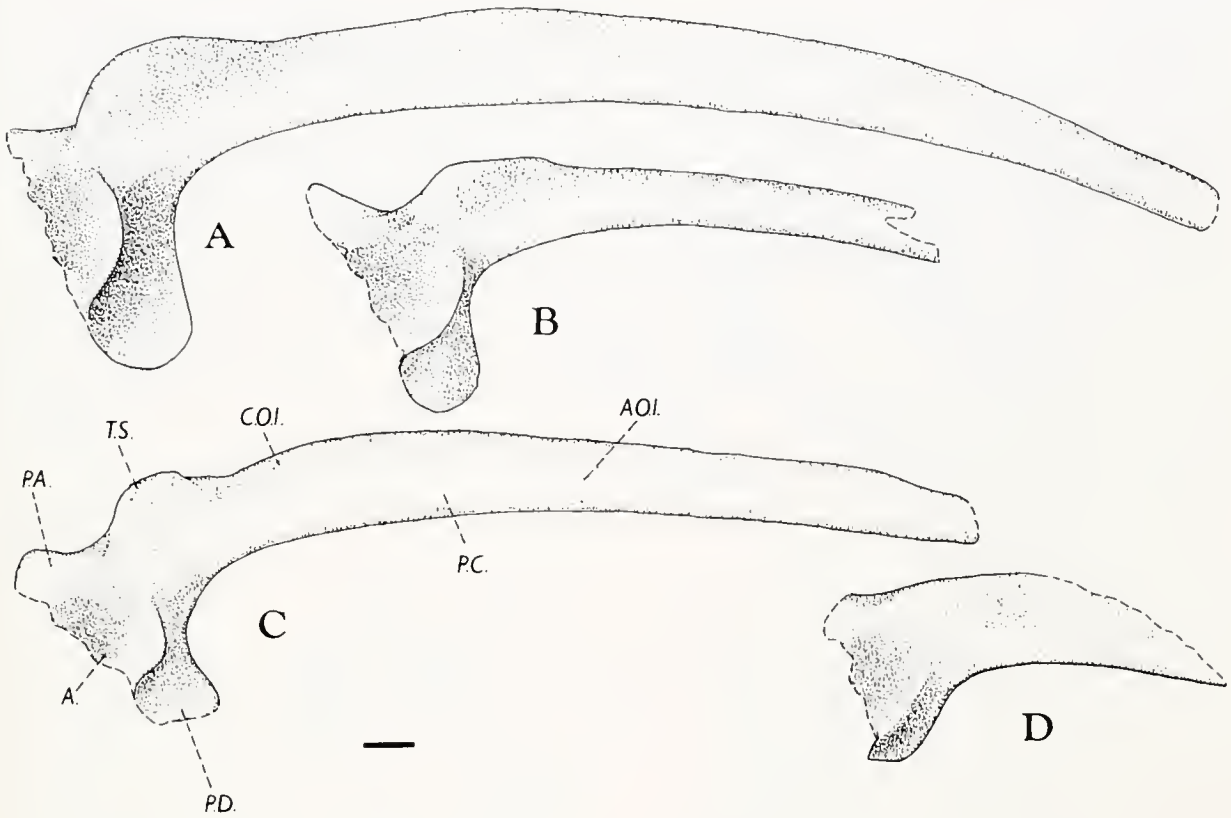

FIG. 3. A- Ranidae indet. Right ilium in lateral view (ZIL/EL/87). B- Ranidae indet. Left ilium in lateral view (ZIL/EL/1). C- Ranidae indet. Left ilium in lateral view (ZIL/EL/14). D- Anura indet. Left ilium in lateral view (ZIL/EL/3). B, C, and D reversed for comparison. Bar equals 1mm. Abbreviations: A. - acetabulum; A. O. I. - ala ossis ilii; C. O. I. - crista ossis ilii; P. A. - pars ascendens; P. C. - parscylindriformis; P. D. - pars descendens; T. S.- tuber superius.

m. pectoralis (portio epicoracoidea, sternalis and abdominalis), whereas the proximal part of the crista itself (its edge) could serve for attachment of two heads of the m. deltoideus (pars clavicularis and scapularis). The third head of the deltoideus muscle (pars episternalis) is fixed to the ventral ridge of the medial epicondylus. The fossula dividens probably served for tendon of the m. coracoradialis. The groove between both the crista medialis and lateralis served no doubt for insertion of the caput profundum of the m. anconeus. The medial crista serves in anurans for attachment of the m. flexor carpi radialis and the lateral crista for the m. extensor carpi radialis. The former has its special function in amplexus. Consequently, the crista medialis is usually better developed in males, and the degree of its development is considered secondary sex character.

Taxonomic notes: Humeri recalling those described above may be found in some individuals of contemporary "brown" frogs, i.e. of *Rana temporaria R. arvalis, R. dalmatina, R. latastei,* and *R. macrocnemis*. I found morphology closely resembling that in ZIL/EL/151 (Fig. 1B) in contemporary *Rana arvalis* (DP FNSP 5830) from S Bohemia (Czechoslovakia), in *R. arvalis* wolterstorfii (DP FNSP 6264) from Soroksar (Hungary), and in *R. latastei* (DP FNSP 6419) from Como (Italy). In other individuals, the cristae and the lingual process were developed to various degree, similar to the condition in the described fossil material. In all cases these humeri belonged to males. Hence, it

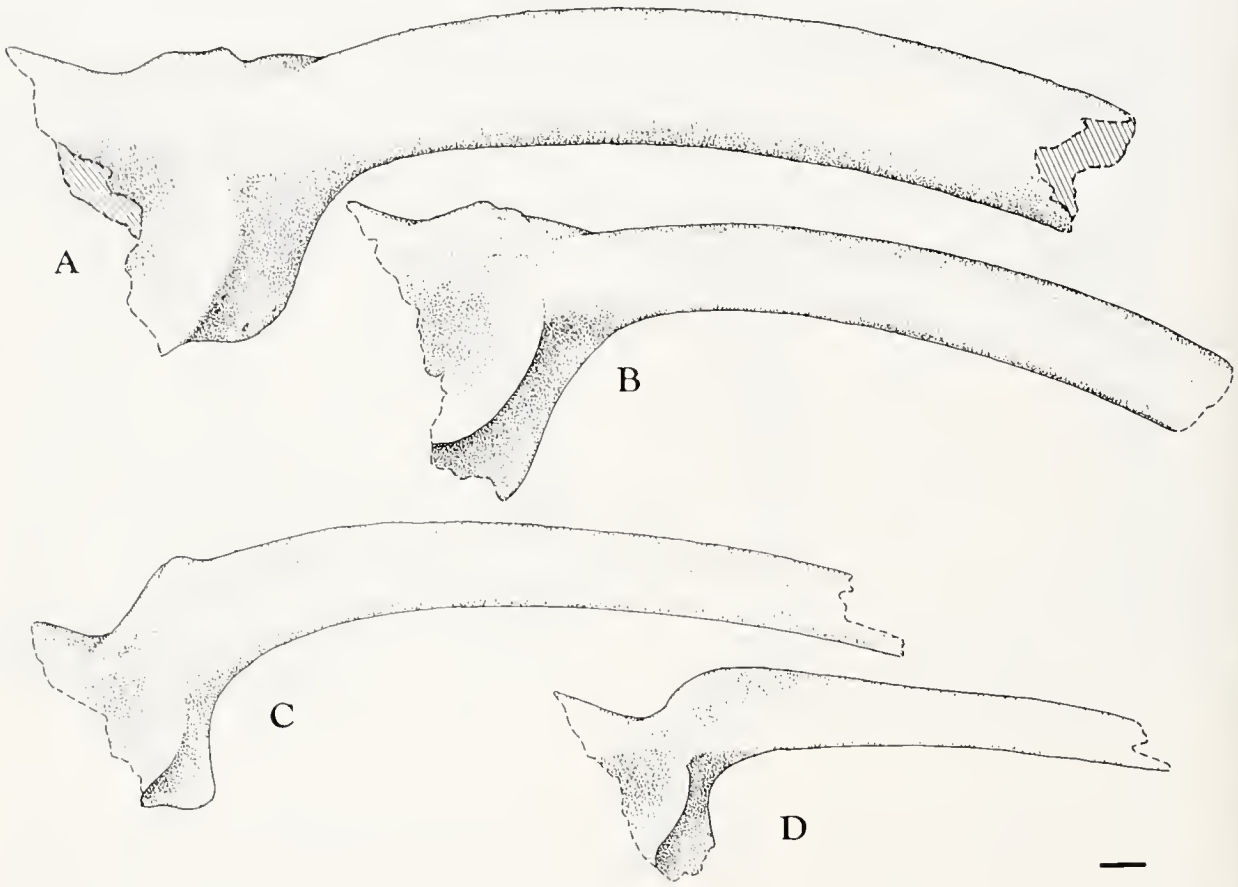

FIG. 4. A- *Bufo* sp. Right ilium in lateral view (ZIL/EL/94). B-*Bufo* sp. Left ilium in lateral view (ZIL/EL/99). C- Ranidae indet. Left ilium in lateral view (ZIL/EL/68). D- Ranidae indet. Right ilium in lateral view (ZIL/EL/111). B and C reversed for comparison. Bar equals 1 mm.

may be concluded that the described characters on the humerus may be ascribed to sexual dimorphism, but they are not present in all males. In any case, relations to contemporary "brown" ranids seems to be beyond any doubt. It is quite possible that the above described humeri assigned to Rana sp. and humeri (and other elements) described below as Ranidae indet. might belong to a single form.

Ranidae indet.

Material: Right coracoid, ZIL/EL/54 (Fig. 7E).

Description: The intumescentia glenoidalis is circular, with distinct but small fovea acetabuli where the ligament of the humerus is inserted. The fovea is surrounded by marginal part for the cartilago paraglenoidalis that connects this bone with the proc. glenoidalis scapulae. The pars epicoracoidealis is nearly regularly arch-like, exceeding by its antero-posterior diameter the lateral part of the bone.

Material: Humeri ZIL/EL/110 (Fig. 2E), ZIL/EL/150 (Fig. 2D), ZIL/EL/168.

Description: The crista ventralis humeri in ZIL/EL/110 (and in ZIL/EL/168 that is similar) is prominent, gradually lowering distally. Part of its margin is tongue-like bent medially. Only within the proximal section of the crista there is a groove along the medial surface of its basis. The crista medialis is well developed, but only in the distal third of the bone. The lateral crista is developed in lesser degree. The medial

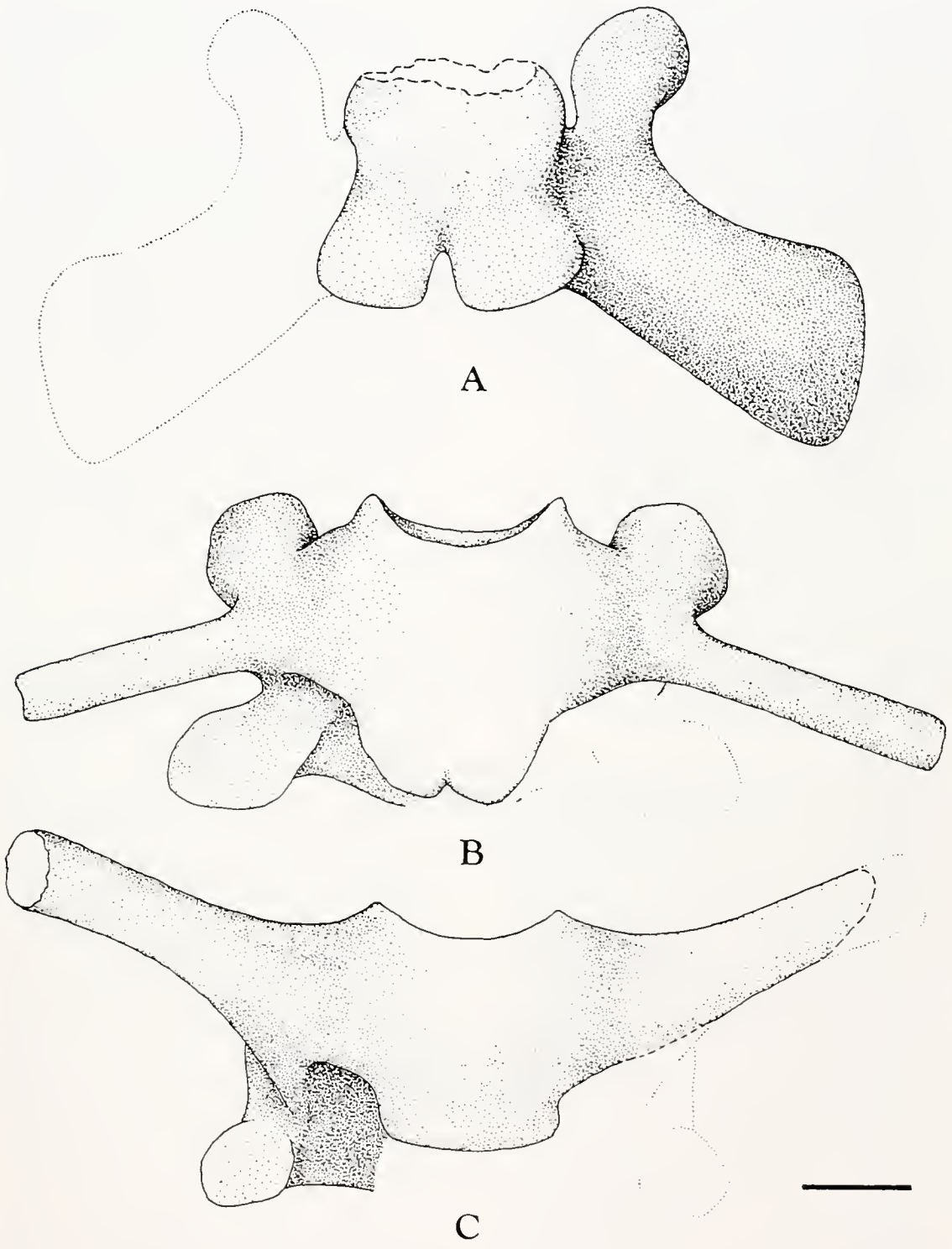

FIG. 5. Ranidae indet. Vertebrae in ventral view. A- Sacral vertebra (ZIL/EL/10). B- V6 (ZIL/EL/70). C- V2 (ZIL/EL/8). Bar equals 1 mm. Fig.6 Ranidae indet. Praesacral vertebrae in dorsal (above) and ventral (below) views. A- V5 (ZIL/EL/17). B- V2 (ZIL/EL/125). Bar equals 1 mm.

epicondylus is well developed, the lateral one is rudimentary. On the medial surface of the diaphysis there is low but discernible crista. Specimen ZIL/EL/150 has its ventral crista well developed, with rounded and almost straight margin. It is thin along its attachment to the diaphysis. This, together with the fact that the diaphysis is oval in cross-section, caused that there is a groove along the basis of the crista, especially well developed on its medial surface. Neither medial nor lateral crista are developed in this specimen, and the lateral epicondylus is absent, too. In spite of these differences, both humeri may be assigned to the Ranidae.

Material: Ilia ZIL/EL/1 (Fig. 3B), ZIL/EL/2, ZIL/EL/14 (Fig. 3C), ZIL/EL/18, ZIL/EL/19, ZIL/EL/28, ZIL/EL/29, ZIL/EL/49, ZIL/EL/68 (Fig. 4C), ZIL/EL/87 (Fig. 3A), ZIL/EL/111 (Fig. 4D), ZIL/EL/135, ZIL/EL/164, ZIL/EL/177. Specimens ZIL/EL/2, ZIL/EL/19, ZIL/EL/29, ZIL/EL/135 and ZIL/EL/177 are similar to ZIL/EL/111 (Fig. 4D) in that the tuber superius is continuous with the crista ilii.

Description: The crista ossis ilii (vexillum of some authors) and the pars cylindriformis can be well distinguished in medial view, whereas only with some difficulties in lateral view. The crista does not reach up to the anterior end of the ala. It is directed dorsally in its section adjacent to the tuber superius, and bent dorsomedially in its anterior portion. Consequently, it forms wide groove on the medial surface of the ala, roofed dorsally by the edge of the crista, and ventrally delimited by the pars cylindriformis. The tuber superius is prominent above the level of the crista (but not in ZIL/EL/111), however, its margin corresponds by its thickness to the edge of the latter. Only posteriorly the tuber has a rounded margin, declined rather laterally. In specimen ZIL/EL/68 the tuber is prominent but not extensive; it has conspicuous ridge running down obliquely from its top. There is a distinct depression between the tuber and pars cylindriformis. The depression extends to the dorsal margin of the ala, separating thus the tuber from the crista. The acetabulum is with acute and prominent margins, considerably lifted above the pars descendens, but rather slanting down towards the pars ascendens. However, even here the margin of the acetabulum is represented by a distinct ridge. There is a considerable notch between the tuber superius and the dorsal margin of the pars ascendens. The dorsal margin of the pars ascendens continues anteroventrally onto the medial surface of the bone as a rounded ridge that disappears after a short distance. ZIL/EL/1 (Fig. 3B) is essentially the same but the crista is much lower than is the dorsoventral diameter of the pars cylindriformis, in whole its extent anterior to the tuber superius. Anteriorwards it is even getting lower, so its transition into the dorsal margin of the pars cylindriformis is indistinct. The tuber is prominent and extensive anteroposteriorly.

Anatomical notes: The lateral surface of the crista ossis ilii is an insertion area for the m. iliacus externus, the other end of which is fixed by a tendon to the proximal part of the femur (Gaupp, 1896, figs 104, 105). The inner surface of the crista is occupied by the m. coccygeo-iliacus that runs to the urostyle. The iliacus externus muscle is, together with the iliacus internus, one of the most robust pelvic muscles in ranids and perhaps it plays an important role in jumping, despite of the fact that its tendon is fixed close to the proximal end of the femur. The tuber superius serves for attachment of the m. glutaeus magnus, m. ilio-fibularis, and m. ilio-femoralis. The first is the most robust muscle of the dorsal side of the thigh, and together with other heads of the m. triceps femoris it stretches the knee joint. All muscles that are inserted on the tuber superius are important for locomotion.

Discussion: Contemporary European ranids mostly have the torus superior ilii continuous with the crista ilii, regardless if they belong to the esculenta or temporaria complexes. However, certain variation exists in this respect, so one can find individuals with prominent torus also in those forms in which it is continuous with

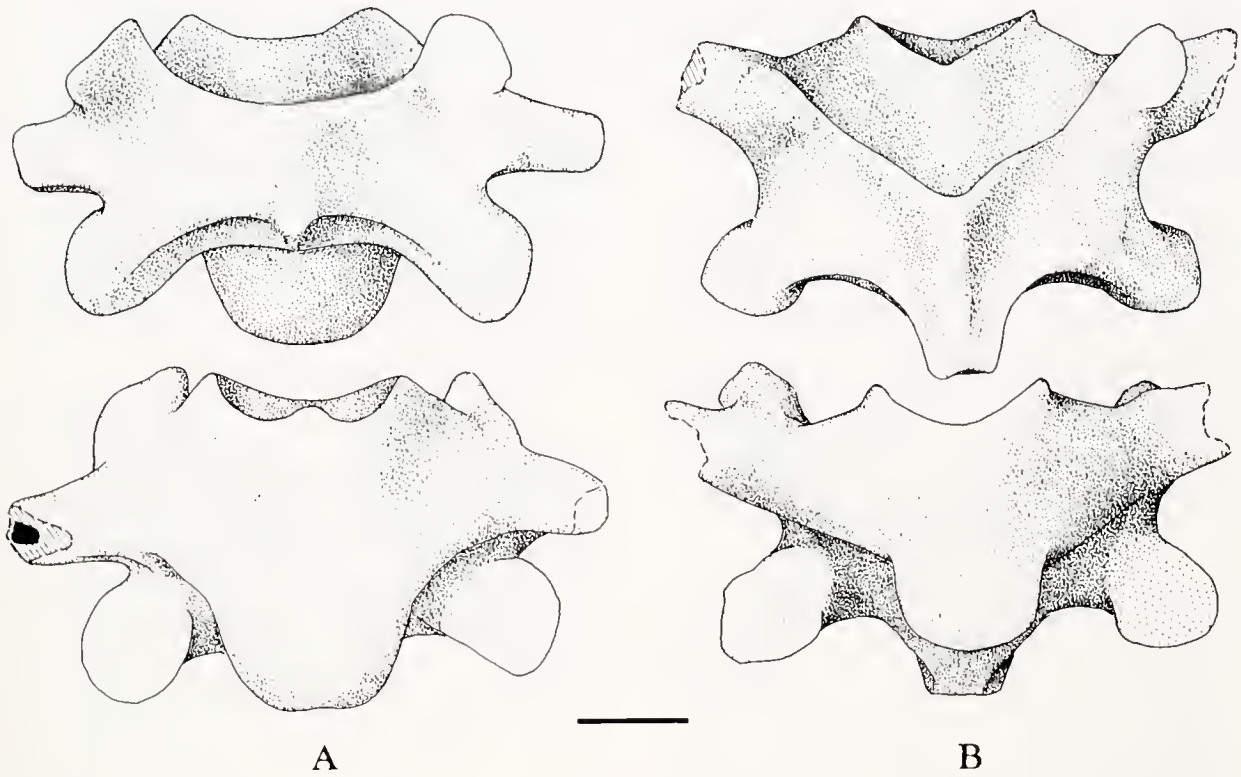

FIG. 6. Ranidae indet. Prae sacral vertebrae in dorsal (above) and ventral (below) views. A- V5 (ZIL/EL/17). B- V2 (ZIL/EL125). Bar equals 1 mm.

the crista in most individuals. This is why more precise assignment is difficult.

Material: Praesacral vertebrae V2 - ZIL/EL/8 (Fig. 5C) and ZIL/EL/125 (Fig. 6B); V3 - ZIL/EL/9; V5 - ZIL/EL/17 (Fig. 6A); V6 - ZIL/EL/70 (Fig. 5B).

Description: The centra are procoelous, dorsoventrally compressed. In V2, the diapophyses are distinctly inclined anteriorly and slightly also ventrally; they are oval in cross-section due to moderate dorsoventral compression. ZIL/EL/125 is similar in its preserved characters but differs in having the postzygapophyses more robust, and the posterior convexity of the centrum more prominent (see Fig. 6B). Besides that, the anterior-posterior distance between the prae- and postzygapophyses is greater than in ZIL/EL/8 because the former processes extend anteriorly beyond the level of the centrum. The neural arches of ZIL/EL/125 (they are not preserved in ZIL/EL/8) produce distinct proc. spinosus which is, as usually in V2 of ranids, directed posteriorly. Its dorsal surface is flat, only anteriorly there is a narrow and low ridge paralleled by a depression on either side. V3 is represented by ZIL/EL/9 which is preserved only as fragment lacking the centrum, but its diapophysis with some rugosity in the middle of its length, as well as an extent of its neural canal and shape of its praezygapophysis, suggest its relations to the ranids. ZIL/EL/17 is V5; it has its proc. spinosus directed dorsally (again, as usual in ranids). Perhaps it might be associated with ZIL/EL/70 (see below), judging by the shape of the centrum in ventral view (also in this specimen the posterior convexity is divided by a slot, though visible only in posterior aspect). Peculiar feature of this specimen is the ventral edge of its anterior concavity which runs out anteriorly in the mid-line (see Fig. 6A). It is difficult to say whether this is of some taxonomic

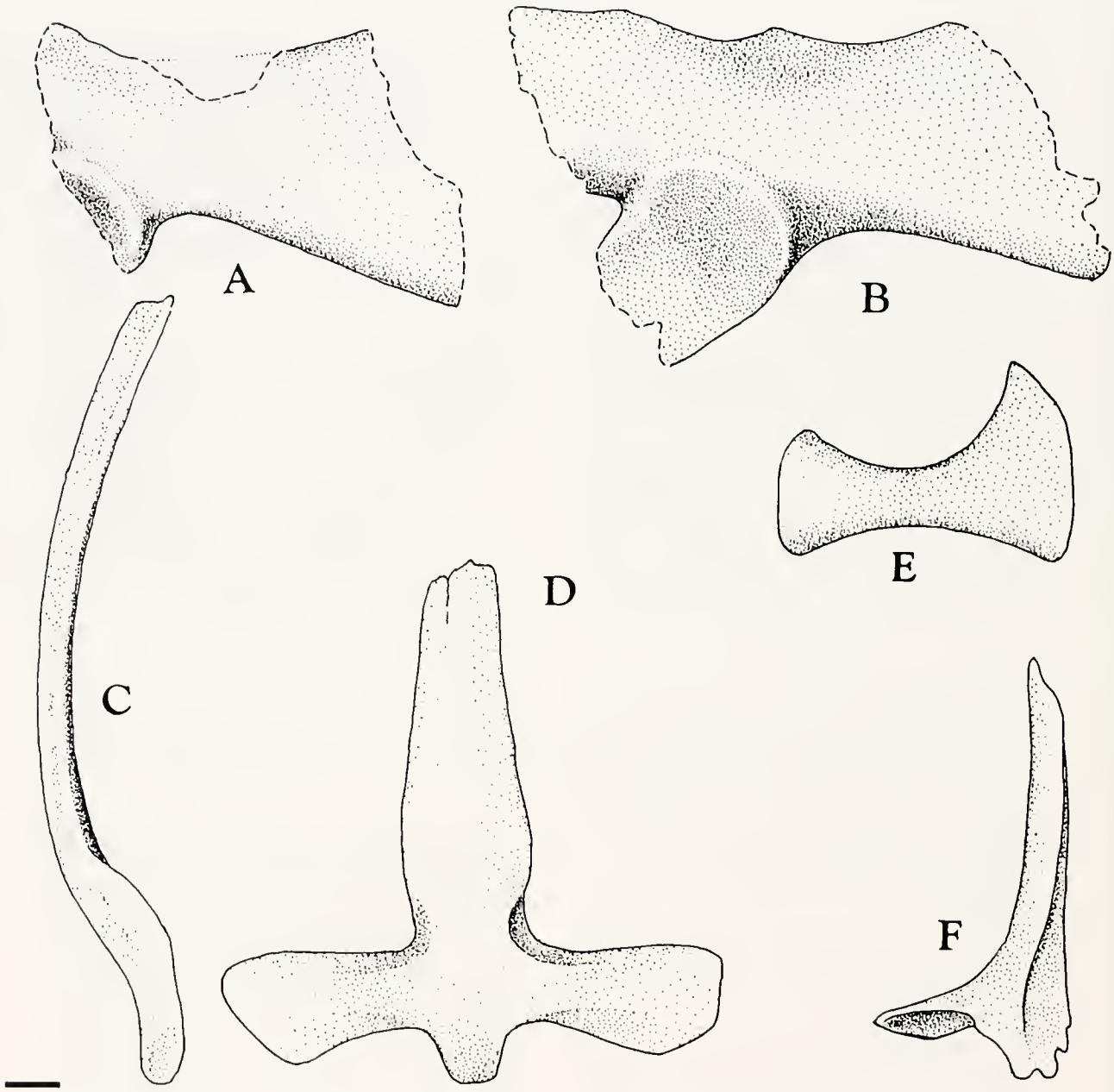

FIG. 7. A- cf. *Bufo* sp., left scapula in lateral view (ZIL/EL/140). B- *Bufo* sp., left scapula in lateral view (ZIL/EL/7). C- Anura indet., left praearticular in dorsal view (ZIL/EL/12). D- Anura indet., parasphenoid (ZIL/EL/185). E-Ranidae indet., right coracoid in ventral view (ZIL/EL/54). F-Anura indet., right pterygoid (ZIL/EL/141). Abbreviations:c. gl. - cavitas glenoidalis; i. gl. - intumescentiaglenoidalis; m.a. - margo anterior; p. a. pars acromialis; p. gl. - proc. glenoidalis. Bar equals 1 mm.

importance. V6 is represented by ZIL/EL/70. Its diapophyses are rounded in cross-section, and are of the same diameter both proximally and distally. They are horizontal, not inclined dorsally. The posterior convexity is clearly divided vertically by a slot which is better developed than in ZIL/EL/17. Signs of such slots may be observed in corresponding vertebrae of some individuals of the contemporary Ranidae (e.g., *Rana esculenta*). All the described praesacral vertebrae have in common a distinct indentation along the posterior edge

of the neural arches; this is interrupted only in the mid-line where a distinct ridge runs down from the proc. spinosus.

All the above features suggest that vertebrae of the Ranidae should be concerned. Bufonids are excluded mainly because of the morphology of their proc. spinosus and because their neural canal is less spacious.

Material: Sacral vertebra ZIL/EL/10 (Fig. 5A).

Description: The centrum is dorsoventrally compressed, bicondylar posteriorly, both condyli being separated by a comparatively wide notch. The anterior side of the centrum is not preserved but comparison with contemporary ranids suggests that there could be a mineralized intervertebral disc. The diapophyses are inclined dorsally, and are distinctly compressed dorsoventrally. The articulation surface of the praezygapophyses is, in correspondence with the inclination of the diapophyses, facing dorsomedially.

Anura indet.

Material: Parasphenoid, ZIL/EL/185 (Fig. 7D).

Description: The shape and proportions of the bone may be seen from Fig. 7D. Among the characters that should be mentioned are the proc. posterior which is well developed, narrow proximal parts (compared with the distal sections) of the lateral processes and of the pars medialis, and distinct indentations on the transition between the pars medialis and lateral processes caused by a low ridge on either side; similar ridge continues on both sides from the lateral edge of the proc. posterior onto the surface of the proc. lateralis where it disappears.

Material: Left praearticular, ZIL/EL/12 (Fig. 7C).

Description: The proc. coronoideus is well developed, nearly vertical in position. The sulcus pro cart. Meckeli is, especially in the posterior moiety of the bone, only moderately developed. These characters do not allow precise assignment.

Material: Right pterygoid, ZIL/EL/141 (Fig. 7F).

Description: The inner surface (margo orbitalis) of the ramus maxillaris does not bear any crista and the ramus itself is almost straight. The distal section of the ramus posterior is broken off, so the real proportions of the bone are difficult to reconstruct.

Material: Ilium, ZIL/EL/3 (Fig. 3D).

Description: Although this ilium is preserved only as a small section, important diagnostic characters are preserved. The crista ossis ilii is well developed, and may be distinguished both in medial and lateral view. In contrast to ranids, the torus superior is not developed, and the anterior margin of the pars descendens is directed posteroventrally instead of ventrally or even anteroventrally (see Bohme 1977, fig. 9).

Material: Praesacral vertebra (most probably V5 or V6), ZIL/EL/11.

Description: Only the centrum and bases of the left transverse process incl. adjacent praezygapophysis are preserved. However, one can conclude after the declination of the proximal part of the transverse process that V5 or V6 should be concerned. The centrum is dorsoventrally compressed and procoelous, though its posterior side is also slightly concave. As its surface does not display spongious structure (indicating a crack) it can be admitted that there could be a free intervertebral disc that in living animal adhered the posterior end of the centrum. The ventral surface of the centrum is almost at the same level as the proximal section of the transverse processes, and the centrum itself is short antero-posteriorly. The praezygapophysis is comparatively small and located far laterally (its distance from the lateral edge of the proximal concavity of the centrum is about half the diameter of

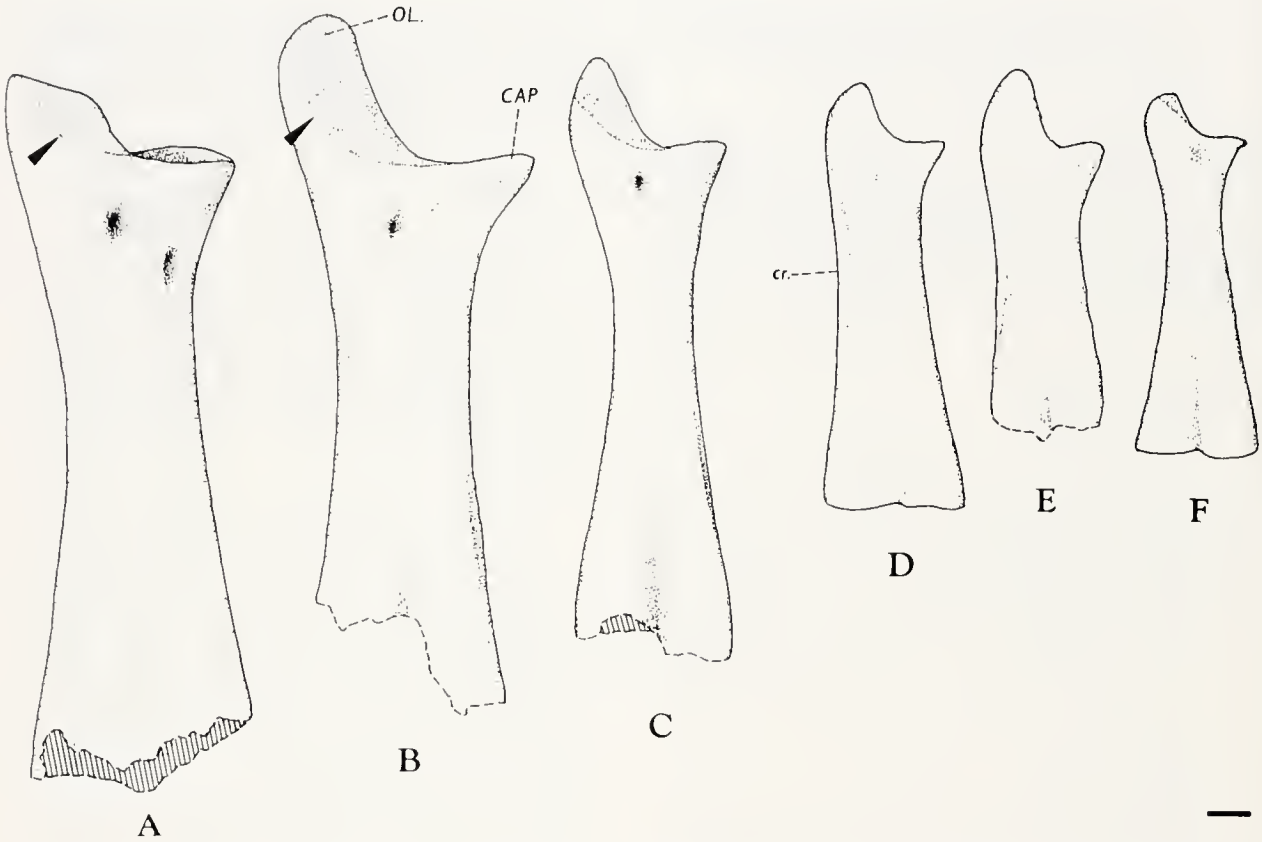

Fig. 8. Radioulnae in medial view. A- *Bufo* sp. (ZIL/EL/62). B-*Bufo* sp. (ZIL/EL/106). C- *Bufo* sp. (ZIL/EL/120). D- Anura indet. (ZIL/EL/36). E- Anura indet. (ZIL/EL/46). F- Anura indet. (ZIL/EL/72). D-F reversed for comparison. Arrows indecate border between periost and that part of the bone without periostal surface. Abbreviations: CAP. - capitulumradioulnae; OL. - olecranon; cr. - crista on the ulnar margin. Line equals 1 mm.

this concavity). The neural arches are comparatively thin, and the neural canal was obviously quite spacious.

Material: Urostyle, ZIL/EL/88.

Description: This element fits morphologically into the variation range of contemporary Ranidae. Both in Ranidae and Bufonidae this range is rather broad which precludes precise assignment of the specimen.

Material: Radioulnae ZIL/EL/36 (Fig. 8D), ZIL/EL/46 (Fig. 8E), ZIL/EL/72 (Fig. 8F), ZIL/EL/73, ZIL/EL/114, ZIL/EL/152.

Description: These radioulnae are medium to small sized (compared with those identified as *Bufo*). A conspicuous character is that most of them are laterally compressed in their columnar section. This results in that their anterior and posterior margins run out in a distinct ridge. The smallest specimen (ZIL/EL/72), however, has its margins rounded. These radioulnae might be ascribed to the Ranidae, however, lack of diagnostic characters of these elements casts some doubts on this assignment.

Accompanying Vertebrate Fauna in the Sample

From Kudaro I Cave, Tsepkin (1980) gave a list of accompanying fishes, Darevsky (1980) mentioned one lizard genus (*Lacerta* sp.), Burchak-Abramovich (1980) gave a list of birds, Gadzhiev (1980) bats, Gromov & Fokanov (1980)

rodents, and Vereshchagin & Baryshnikov (1980) large mammals. In the sample that was placed at my disposal there were, besides frogs, also two different forms of birds, and following mammals (determination by Dr. Ivan Horacek, Department of Zoology, Charles University, Prague): *Talpa* cf. *caeca Prometheomys schaposchnikovi, Arvicola* cf. *terrestris, Microtus* cf. *gud, Microtus* ("*Pitymys*") cf. *majori*, and cf. *Lupus*.

Conclusions

Determination of the material revealed that its substantial part belongs to the genus *Bufo* and to the family Ranidae. Minor part (represented by fragmentary or less numerous elements) could be determined only as Anura indet. Precise determination was impossible because of supposed individual and developmental variation. Nevertheless, results of this determination show that generic composition of the Holocene anuran fauna in this region was basically the same as contemporary one. The genus *Bufo* in the corresponding altitudes of Caucasus is nowadays represented by. *Bufo verrucosissimus*, and *B. viridis*, genus *Rana* by *R. macrocnemis*, and possibly also by R. *ridibunda* (Bannikov et al., 1977; Kuznetsov, 1974; Tuniyev, 1990). Besides, there occurs sporadically also *Pelodytes caucasicus* in South Ossetia, however, presence of this genus in the fossil material could not be confirmed.

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