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Comparative Osteology of Japanese Frogs and Toads for Paleontological Studies (III): *Rana**

By

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Abstract—The osteological characters of 14 species of the genus *Rana* are discussed on nine elements: fronto-parietal, ethmoid, parasphenoid, maxilla, scapula, humerus, sacrum, ilium, and femur. The genus *Rana* in Japan have been divided into two or three subgenera by authors, but I found no osteological reasons to recognized these subgenera.

Introduction

Six families, six genera, and 27 species of the Anura are distributed throughout Japan (NAKAMURA and UÉNO, 1963). A large number of them belong to the genus *Rana*: 17 species in two subgenera. Since *Rana* (*R.*) *catesbeiana*, the bull frog, was introduced from the United States in 1919 (NAKAMURA and UÉNO, 1963), this species is not included in this paper.

In this section, the author describes the osteology of the genus *Rana*. Fossil *Rana* were found from many localities: *Rana architemporaria* OKADA, 1937 from Kabutoiwa, Nagano Pref., *Rana siobarensis* SHIKAMA, 1955 from Shiobara, Tochigi Pref., *Rana* sp. from Shiriya, Aomori Pref., (HASEGAWA, 1972), etc. This paper provides a necessary basis for identifications of anuran fossils.

The generic and specific characters are described here following the classifications of OKADA (1966) and NAKAMURA and UÉNO (1963). Osteological terminologies in CHANTELL (1968), ECKER (1956), and NOKARIYA (1983) are used.

The specimens of skeletal elements examined are deposited in the collection of the National Science Museum, Tokyo.

List of Specimens Examined

Order: Salientia

Suborder: Firmisternia

Family: Ranidae

Genus: *Rana* LINNAEUS, 1758

Rana (*Rana*?) *ishikawae* (STEJNEGER, 1901)

Rana (*Rana*?) *namiyei* STEJNEGER, 1901

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Rana (*Rana*?) *narina* STEJNEGER, 1901
Rana (*Rana*) *okinavana* BOETTGER, 1895
Rana (*Rana*) *limnocharis limnocharis* WIEGMANN, 1835
Rana (*Rana*) *tagoi* Y. OKADA, 1928
Rana (*Rana*) *nigromaculata* HALLOWELL, 1860
Rana (*Rana*) *rugosa* SCHLEGEL, 1838
Rana (*Rana*) *japonica japonica* GÜNTHER, 1858
Rana (*Rana*) *ornativentris* WERNER, 1904
Rana (*Rana*) *chensinensis dybowskii* GÜNTHER, 1876
Rana (*Babina*) *holsti* BOULENGER, 1892
Rana (*Babina*) *subaspera* BARBOUR, 1908
Rana adenopleura BOULENGER, 1909

Description

Family Ranidae

Genus ***Rana*** LINNAEUS, 1758

Fronto-parietal (Fig. 1, 1–14): no ornamentation present on dorsal surface; width narrow compared to its length; neither supraorbital crest nor occipital canal present; occipital process well-developed.

Ethmoid (Fig. 2, 1–28): longer than its width; anterior projection scarcely developed; posterior dorsal edge arches anteriorly and its proximal end far posterior to posterior corner of flange.

Parasphenoid (Fig. 3, 1–14): blade longer than its width across alae; both ends of alae expanded antero-posteriorly.

Maxilla (Fig. 1, 15–42): teeth present; dorsal process developed and projecting dorsally.

Scapula (Fig. 4, 1–28): anterior margin of clavicular process concave; from dorsal view, ridge running along anterior margin of coracoid process.

Humerus (Fig. 6, 1–21): distal end of medial epicondyle below to that of olecranon ball or at same level as that of olecranon ball; spina tuberculi medialis present or not; sexes easily distinguishable by medial flange; width of their shaft wider than that of *Rhacophorus*; long axis of olecranon ball matches with that of shaft; from posterior view, outline of olecranon scar clearly visible.

Sacrum (Fig. 5, 1–14): anterior surface of centrum convex; diapophysis rod-like in shape and projecting latero-postero-dorsally; direction and shape of ridge differing according to species; both condyles separate from each other.

Ilium (Fig. 6, 22–35): ilial crest well-developed but that of *Rana* (*Rana*) *tagoi* weakly developed; two types present, the X type, where the posterior ventral end of dorsal protuberance contacts dorsal margin of acetabular fossa, the other, the Y type, where the posterior ventral end of dorsal protuberance does not contact dorsal margin

of acetabular fossa; antero-postero length of ventral acetabular expansion narrow.

Femur (Fig. 5, 15): no deltoid crest present.

Rana (Rana?) ishikawae (STEJNEGER, 1901)

Fronto-parietal (Fig. 1, 10): occipital process weakly developed, however, in male, developed and projecting postero-laterally; occipital canal not reaching posterior margin of orbital foramen; parietal crest well-developed and its posterior end running to occipital process.

Ethmoid (Fig. 2, 23–24): anterior dorsal margin of body scarcely arches anteriorly; anterior ventral margin of body scarcely arches posteriorly; processus lateralis poorly developed and projecting antero-laterally; no flange present; posterior dorsal edge concave and square in shape; its anterior end far posterior to distal edges of orbitonasal foramen.

Parasphenoid (Fig. 3, 11): antero-postero length of alae almost constant; alae inclined slightly posteriorly; distal end of posterior process at same level as posterior end of alae.

Maxilla (Fig. 1, 35–36): anterior end of pars facialis convex; dorsal margin of pars facialis almost straight; dorsal process projects antero-dorsally; posterior margin of dorsal process convex.

Scapula (Fig. 4, 19–20): in female, ridge on dorsal surface of coracoid process weakly developed; in male, ridge running along anterior margin of coracoid process.

Humerus (Fig. 6, 4–5): spina tuberculi medialis present; anterior end of medial epicondyle at same level as that of olecranon ball; length from distal end of ventral crest to proximal end of olecranon ball shorter than that of *R. (R?) narina*; long axis of olecranon ball slightly external to that of shaft.

Sacrum (Fig. 5, 3): distal margin of neural arch concave; ridge on diapophyses lambdoid shaped and disappears on way to both ends; in female, ridge especially long; antero-postero length of ridge long.

Ilium (Fig. 6, 32): well-developed ilial crest present; condition of dorsal protuberance in Y type; angle between dorsal margin of dorsal acetabular expansion and posterior margin of dorsal protuberance wider than that of *R. (R?) narina*; ilial shaft angle at about 40°.

Remarks: large sized frog. This species resembles *R. (R?) narina*. Three specimens are available for study.

Rana (Rana?) namiyei STEJNEGER, 1901

Fronto-parietal (Fig. 1, 11): width gradually increases its width towards its proximal end; width especially narrow compared to its length; occipital process well-developed; distal end of occipital process extending beyond posterior end of body; T

shaped ridge running along sagittal suture of body; in adult specimen, both right and left bodies fused.

Ethmoid (Fig. 2, 19–20): anterior projection developed; processus lateralis weakly developed and projecting antero-laterally; both flanges poorly preserved; figure of dorsal edge concave square in shape; anterior end of this concave far posterior to distal corner of both flanges.

Parasphenoid (Fig. 3, 14): anterior margin of alae perpendicular to blade; distal end of posterior process posterior to both posterior corners of alae; width of blade especially narrow compared to length; one specimen, anterior one third of blade divided into two parts; two ridges running parallel with each other on anterior part of ventral surface.

Maxilla (Fig. 1, 37–38): anterior end of pars facialis convex as in a beak; dorsal process weakly projecting; pterygoid process well-developed; proximal part of lingual shelf especially developed; there is highest part of body at posterior one fifth of body.

Scapula (Fig. 4, 3–4): medial anterior margin of body weakly convex; from ventral view, a deltoid shallow depression present on ventral surface of clavicular process; from dorsal view, ridge running along anterior margin of coracoid process from proximal end to base of coracoid; it arches anteriorly to center of body; this ridge not reaching anterior margin of body.

Humerus (Fig. 6, 3): spina tuberculi medialis present; distal end of medial epicondyle below to that of olecranon ball; intertubercular groove present; width at above part of olecranon ball narrow compared to that of *R.* (*B.*) *holsti*.

Sacrum (Fig. 5, 4): lambdoid ridge disappears on way to both distal ends of diapophyses; ridge inclined weakly anteriorly; anterior end of centrum projecting anterior to proximal end of prezygapophyses.

Ilium (Fig. 6, 33): well-developed ilial crest present; posterior dorsal corner of dorsal protuberance at obtuse angle; condition of dorsal protuberance in Y type; ilial shaft angle at about 40°.

Remarks: large sized frog. Four specimens are available for study.

Rana (*Rana*?) *narina* STEJNEGER, 1901

Fronto-parietal (Fig. 1, 8): width almost constant; occipital process weakly developed.

Ethmoid (Fig. 2, 21–22): length especially longer than its width; anterior projection poorly developed; posterior ventral edge wavy; posterior dorsal edge arches anteriorly and its proximal end extending posterior to posterior corner of both flanges.

Parasphenoid (Fig. 3, 10): blade expanded at middle; anterior end of blade pointed; anterior margin of alae perpendicular to blade; both ends of alae expanded; distal end of posterior process at same level as both posterior ends of alae.

Maxilla (Fig. 1, 19–20): anterior one third of lingual shelf well-developed; pterygoid process weakly developed.

Scapula (Fig. 4, 25–26): anterior margin of body strongly arches posteriorly; from ventral view, deltoid shallow depression present on ventral surface of clavicular process; medial margin of clavicular process straight; from dorsal view, ridge running along anterior margin of coracoid process from its proximal end to nearly central anterior margin of body.

Humerus (Fig. 6, 8–9): spina tuberculi medialis present; distal end of medial epicondyle at same level as that of olecranon ball; width of ventral crest thin and almost constant; from posterior view, width of olecranon scar narrow compared to its height; general shape of their shaft resemble that of *R.* (*R.*) *chensinensis* but this species has a developed lateral flange.

Sacrum (Fig. 5, 1): ridge ∩ shaped and running along long axis of diapophysis to nearly distal end; cross section of diapophyses delta in shape; from dorsal view, angle between both right and left diapophyses narrow; general figure of it bow in shape.

Ilium (Fig. 6, 28): dorsal protuberance well-developed; condition of it in Y type; base of ilial shaft contacts upper part of anterior end of acetabular fossa; ilial shaft angle at about 50°; general shape of this resembles that of *R.* (*R*?) *ishikawae*.

Remarks: large sized frog. General shape of this species resembles that of *R.* (*R*?) *ishikawae*. Four specimens are available for study. General figure of humerus resembles that of *R.* (*R.*) *chensinensis*; this species has a lateral flange but *R.* (*R.*) *chensinensis* does not have it; length from distal end of ventral crest to proximal end of olecranon ball of this species longer than that of *R.* (*R*?) *ishikawae*; central posterior margin of neural arch of sacrum not concave like that of other *Rana*; angle between dorsal margin of dorsal acetabular expansion and posterior margin of dorsal protuberance narrower than that of *R.* (*R*?) ishikawae.

Rana* (*Rana*) *okinavana BOETTGER, 1895

Fronto-parietal (Fig. 1, 2): width slightly decreases its width towards its proximal end; occipital process weakly developed; medial posterior corner of orbital foramen slightly concave.

Ethmoid (Fig. 2, 3–4): no anterior projection present; anterior ventral and dorsal margin of body slightly arches posteriorly; processus lateralis weakly developed; posterior ventral edge arches anteriorly; proximal end of posterior dorsal edge far posterior to level of both posterior corners of flanges.

Parasphenoid (Fig. 3, 5): blade far longer than its width across alae; width of blade narrow compared to its length; anterior margin of alae perpendicular to blade; distal end of alae thin and easy to break; neck of blade weakly developed; distal end of posterior process posterior to level of both posterior ends of alae.

Maxilla (Fig. 1, 29–30): dorsal process almost perpendicular to body; antero-postero length short compared to its body.

Scapula (Fig. 4, 9–10): from dorsal view, ridge running along anterior margin of

coracoid process from its proximal end to base and continues parallel with long axis of body.

Humerus (Fig. 6, 19): spina tuberculi medialis scarcely developed; distal end of medial epicondyle at same level as that of olecranon ball; shaft strongly arches anteriorly; intertubercular groove clear visible; from posterior view, lateral margin of olecranon scar not contact that of shaft.

Sacrum (Fig. 5, 12): ridge ∩ shaped and running to nearly distal ends of diapophyses; this ridge weakly developed; angle between right and left ridges wide.

Ilium (Fig. 6, 23): ilial crest well-developed and width thin; dorsal protuberance well-developed; condition of dorsal protuberance in X type; ilial shaft angle at about 80°.

Remarks: tiny frog. General figure of this species resembles that of *R.* (*R.*) *limnocharis*. Two specimens are available for study.

Rana (*Rana*) *limnocharis limnocharis* WIEGMANN, 1835

Fronto-parietal (Fig. 1, 4): width gradually decreases its width towards its proximal end; occipital process well-developed; it broad but short; occipital canal present but not reaching medial posterior corner of orbital foramen; medial posterior corner of orbital foramen concave; ridge running along long axis of body at central posterior one half of body.

Ethmoid (Fig. 2, 11–12): processus lateralis projecting antero-laterally; both orbitonasal foramina scarcely seen from below; both flanges convex laterally; posterior ventral edge scarcely arches anteriorly; posterior dorsal edge arches anteriorly and its proximal end posterior to level of both posterior corner of flanges; lateral margin of body slightly inclined anteriorly.

Parasphenoid (Fig. 3, 7): anterior margin of alae perpendicular to blade; posterior margin of alae strongly arches anteriorly; both distal ends of alae expanded antero-posteriorly; neck of blade developed; tip of posterior process at same level as posterior ends of alae.

Maxilla (Fig. 1, 33–34): dorsal margin of pars facialis slightly arches antero-dorsally; height of pars facialis very high; dorsal process weakly projecting dorsally; only proximal part of lingual shelf developed; general figure of bone resembles that of *Rhacophorus schlegelii*.

Scapula (Fig. 4, 11–12): anterior central margin of body convex; from dorsal view, ridge running along anterior margin of coracoid process from its proximal end to center of body.

Humerus (Fig. 6, 20): no spina tuberculi medialis present; distal end of medial epicondyle below to level of that of olecranon ball; size of olecranon ball small compared to that of shaft; length of ventral crest short compared to that of shaft; neither lateral nor medial flanges present; it is harder to identify each sex; from posterior view, lateral margin of olecranon scar contacts that of shaft.

Sacrum (Fig. 5, 13): ridge ∩ shaped and contacts middle of posterior margin of diapophyses; angle between right and left ridges narrower than that of *R.* (*R.*) *rugosa* and *R.* (*R.*) *okinavana*; anterior margin of prezygapophyses almost straight and figure of it L shaped; it turned laterally.

Ilium (Fig. 6, 27): ilial crest well-developed; condition of dorsal protuberance in Y type; general shape of this species resembles that of *R.* (*R*?) *namiyei*; ilial shaft angle at about 30°.

Remarks: small sized frog. Five specimens are available for study.

Rana* (*Rana*) *tagoi Y. OKADA, 1928

Fronto-parietal (Fig. 1, 1): width almost constant; occipital process poorly developed; figure of body resembles that of *R.* (*R.*) *okinavana*.

Ethmoid (Fig. 2, 9–10): anterior projection slightly developed; processus lateralis well-developed and projecting antero-laterally; distance between both distal ends of processus lateralis almost equal to body length; posterior ventral edge weakly wavy; posterior dorsal edge wavy and its proximal end posterior to posterior corner of flange.

Parasphenoid (Fig. 3, 4): width of blade broad compared to its length; alae slightly inclined posteriorly; tip of posterior process at same level as both posterior ends of alae; figure of body resembles that of *R.* (*R.*) *rugosa*.

Maxilla (Fig. 1, 27–28): anterior margin of pars facialis inclined dorsally; dorsal process weakly developed and slightly projecting dorsally; pterygoid process weakly developed; distal end of body not pointed.

Scapula (Fig. 4, 15–16): from ventral view, anterior margin of articular fossa weakly arches anteriorly; neck of body weakly developed; from dorsal view, ridge running along anterior margin of coracoid process from its proximal end to base.

Humerus (Fig. 6, 15–16): no spina tuberculi medialis present; distal end of medial epicondyle at same level as that of olecranon ball; in male, size of lateral flange larger than that of medial flange; from posterior view, olecranon scar small and unclearly; in male, lateral flange well-developed.

Sacrum (Fig. 5, 14): ridge lambdoid or ↑ shaped and running nearly to both distal ends of diapophyses; from dorsal view, figure of diapophyses bow-like in shape; prezygapophyses well projecting anteriorly.

Ilium (Fig. 6, 22): ilial crest weakly developed; condition of dorsal protuberance in X type; ilial shaft angle at 60°–75°.

Remarks: small sized frog. Two specimens are available for study.

Rana* (*Rana*) *nigromaculata HALLOWELL, 1860

Fronto-parietal (Fig. 1, 9): occipital process developed and projecting posteriorly; tip of it at same level as distal end of body; ridge running along dorsal surface of occipital process; parietal crest developed.

Ethmoid (Fig. 2, 25–26): processus lateralis projecting antero-laterally; both flanges slightly developed; posterior dorsal edge well arches anteriorly and its proximal end at same level as both posterior corner of flanges.

Parasphenoid (Fig. 3, 9): blade slightly longer than its width across alae; anterior margin of alae perpendicular to blade; both distal ends of alae expanded antero-posteriorly; shallow depression present on both ventral surfaces of alae; tip of posterior process posterior to both distal ends of alae.

Maxilla (Fig. 1, 17–18): anterior end of pars facialis convex; dorsal margin of pars facialis almost straight; dorsal process projecting dorso-posteriorly; pterygoid process developed.

Scapula (Fig. 4, 17–18): shallow depression present on ventral surface of clavicular process; from dorsal view, ridge running along anterior margin of coracoid process from its proximal end to base.

Humerus (Fig. 6, 6–7): spina tuberculi medialis weakly present; tip of medial epicondyle at same level as that of olecranon ball; width broad compared to its length; in male, medial flange present but in female, not present.

Sacrum (Fig. 5, 7): diapophysis rod-like in shape and projecting latero-postero-dorsally; ridge ∩ shaped and disappearing on way to distal end of diapophysis; from lateral view, this ridge inclined anteriorly.

Ilium (Fig. 6, 29): ilial crest well-developed; dorsal protuberance developed and condition of it in Y type; size of acetabular fossa small compared to that of body; ilial shaft angle at 45°–60°.

Remarks: medium sized frog. This species very resembles *R.* (*R.*) *brevipoda* and especially postcranial bone. 22 specimens are available for study.

Rana* (*Rana*) *rugosa SCHLEGEL, 1838

Fronto-parietal (Fig. 1, 14): width gradually decreases its width towards its proximal end; occipital process well-developed and projecting postero-laterally; tip of it extending posterior to distal margin of body; occipital canal present; parietal crest slightly present.

Ethmoid (Fig. 2, 7–8): length almost equal to its width; anterior projection slightly developed; anterior dorsal margin of body arches anteriorly; processus lateralis projecting antero-laterally; distance between both distal ends of processus lateralis longer than body length; both flanges slightly developed; posterior dorsal edge arches anteriorly and its proximal end at same level as both distal corner of flanges; general figure of bone resembles that of *Rhacophorus*.

Parasphenoid (Fig. 3, 2): blade slightly longer than its width across alae; anterior margin of alae perpendicular to blade; posterior margin of alae scarcely arches anteriorly; distal end of posterior process at same level as posterior ends of alae.

Maxilla (Fig. 1, 31–32): dorsal margin of pars facialis almost straight; pterygoid process developed; proximal end of lingual shelf well-developed and inclined dorsally.

Scapula (Fig. 4, 1–2): from ventral view, anterior margin of articular fossa slightly arches anteriorly; from dorsal view, ridge developed and running along anterior margin of coracoid process from its proximal end to distal one half of body via center of body; figure of this scapula resembles that of *R.* (*R.*) *okinavana*.

Humerus (Fig. 6, 17–18): spina tuberculi medialis well-developed; tip of medial epicondyle at same level as that of olecranon ball; lateral flange weakly developed; width of shaft broad compared to its length; shaft arches anteriorly from lateral view.

Sacrum (Fig. 5, 9): diapophysis rod-like shaped and projecting latero-postero-dorsally; ridge + shaped and running to nearly both distal ends of diapophyses; this ridge running across long axis of diapophysis; anterior margin of prezygapophyses straight and width of it broad; from dorsal view, angle between both diapophyses broadest among Japanese *Rana*.

Ilium (Fig. 6, 26): ilial crest well-developed; dorsal protuberance well-developed and condition of it in Y type; angle between dorsal margin of dorsal acetabular expansion and posterior margin of dorsal protuberance wider than that of *R.* (*R.*) *ornativentris*; base of ilial shaft contacts anterior end of acetabular fossa; ilial shaft angle at about 80°–90°.

Remarks: small sized frog. Eleven specimens are available for study.

Rana (*Rana*) *japonica japonica* GÜNTHER, 1858

Fronto-parietal (Fig. 1, 7): width almost constant; occipital process developed and tip of it extending posterior to distal margin of body.

Ethmoid (Fig. 2, 27–28): width almost constant; anterior projection slightly developed; processus lateralis developed and projecting antero-laterally; distance between right and left of processus lateralis at same length as body one; posterior ventral edge almost straight; posterior dorsal edge wavy and its anterior end extending posterior to posterior ends of flanges.

Parasphenoid (Fig. 3, 8): blade slightly longer than its width across alae; anterior margin of alae perpendicular to blade; antero-postero length of alae broad compared to blade; neck of blade developed; distal end of posterior process at same level as posterior ends of alae.

Maxilla (Fig. 1, 15–16): anterior end of pars facialis convex; dorsal process projecting slightly antero-dorsally; posterior margin of dorsal process slightly inclined anteriorly; pterygoid process well-developed.

Scapula (Fig. 4, 27–28): from ventral view, deltoid shallow depression present on ventral surface of clavicular process; from dorsal view, ridge running along anterior margin of coracoid process from its proximal end to center of body.

Humerus (Fig. 6, 12): spina tuberculi medialis present; distal end of medial epicondyle below to that of olecranon ball; width of shaft narrow compared to its length.

Sacrum (Fig. 5, 2): diapophysis rod-like in shape and projecting latero-postero-dorsally; ridge lambdoid shaped and contacts central posterior margin of diapophysis;

angle between right and left of diapophysis narrow; anterior end of centrum well projecting anteriorly.

Ilium (Fig. 6, 30): ilial crest developed; condition of dorsal protuberance in Y type; size of acetabular fossa small compared to that of body; ilial shaft angle at 45°–60°.

Remarks: medium sized frog. This species similar to *R.* (*R.*) *ornativentris*. Two specimens are available for study.

Rana (*Rana*) *ornativentris* WERNER, 1904

Fronto-parietal (Fig. 1, 6): width gradually decreases its width towards its proximal end; occipital process developed and projecting posteriorly; its distal end anterior to distal margin of body; occipital canal present but not reaching posterior margin of orbital foramen; neck of medial posterior corner of orbital foramen slightly developed.

Ethmoid (Fig. 2, 5–6): processus lateralis projecting antero-laterally; flange weakly developed; posterior ventral edge slightly arches anteriorly; posterior dorsal edge wavy and its proximal end slightly posterior to posterior ends of flanges.

Parasphenoid (Fig. 3, 1): blade slightly longer than its width across alae; anterior margin of alae almost perpendicular to blade; posterior margin of alae strongly arches anteriorly; both distal ends of alae expanded antero-posteriorly; neck of blade slightly developed; distal end of posterior process at same level as posterior ends of alae.

Maxilla (Fig. 1, 21–22): anterior margin of pars facialis almost straight and inclined dorsally; dorsal margin of pars facialis almost straight; dorsal process projecting dorsally; pterygoid process weakly developed.

Scapula (Fig. 4, 21–22): from dorsal view, ridge running along anterior margin of coracoid process from its proximal end to base and continues parallel with anterior margin of body; antero-postero length of proximal end of clavicular process almost equal to that of distal end of body.

Humerus (Fig. 6, 13–14): spina tuberculi medialis weakly developed or not in female; distal end of medial epicondyle at same level as that of olecranon ball; from lateral view, anterior margin of ventral crest straight; from anterior view, a part of anterior margin of ventral crest turned medially.

Sacrum (Fig. 5, 10): diapophysis rod-like in shape and projecting latero-postero-dorsally; ridge lambdoid shaped and running across long axis of diapophysis to its distal end; this ridge running on anterior margin of neural arch; young specimen, this ridge+or lambdoid in shape.

Ilium (Fig. 6, 31): ilial crest developed; condition of dorsal protuberance in Y type; ilial shaft angle at 45°–60°; shape of this body resembles that of *R.* (*R.*) *rugosa* except by ilial shaft angle.

Remarks: medium sized frog. 13 specimens are available for study.

Rana (Rana) chensinensis dybowskii GÜNTHER, 1876

Fronto-parietal (Fig. 1, 5): width slightly broad compared to its length; occipital process poorly developed; occipital canal present but narrow; parietal crest weakly present.

Ethmoid (Fig. 2, 1–2): width of distal end of body slightly broader than that of proximal end of body; posterior ventral edge well arches anteriorly; flange weakly present.

Parasphenoid (Fig. 3, 3): blade almost equal to its width across alae; width of blade broad compared to its length; anterior margin of alae almost perpendicular to blade; both distal ends of alae expanded antero-posteriorly; neck of blade developed; tip of posterior process extends posterior ends of alae.

Maxilla (Fig. 1, 25–26): anterior end of pars facialis convex; dorsal process poorly present; pterygoid process weakly developed; proximal part of lingual shelf developed and inclined ventrally.

Scapula (Fig. 4, 13–14): from ventral view, anterior margin of articular fossa strongly arches anteriorly; from dorsal view, ridge weakly developed and running along anterior margin of coracoid process.

Humerus (Fig. 6, 10–11): spina tuberculi medialis scarcely developed; tip of medial epicondyle at same level as that of olecranon ball; lateral flange present in male; in male, medial flange developed and its proximal end reaching middle of medial side of shaft; intertubercular groove clear and well-developed; its proximal end reaching distal margin of head; a part of anterior margin of ventral crest projecting medially; from posterior view, height of olecranon scar high compared to its width.

Sacrum (Fig. 5, 11): diapophysis rod-like in shape and projecting latero-postero-dorsally; ridge + shaped and disappears on way to distal end of diapophysis; ridge on long axis of centrum very thin.

Ilium (Fig. 6, 25): ilial crest weakly developed; dorsal protuberance weakly developed and condition of it in Y type; ilial shaft angle at about 85°.

Remarks: medium sized frog. Five incomplete specimens are available for study.

Rana (Babina) holsti BOULENGER, 1892

Fronto-parietal (Fig. 1, 12): width slightly increases its width towards its proximal end; occipital process scarcely developed; ridge running on occipital process; neck of medial posterior corner of orbital foramen well-developed; parietal and supraorbital crests well-developed; parietal crest running parallel with posterior margin of body and contacts posterior end of supraorbital crest; in adult specimen, both bodies fused.

Ethmoid (Fig. 2, 17–18): anterior projection developed; width of ventral anterior projection narrow; processus lateralis projecting antero-laterally; both orbitonasal foramina can be seen from below; both flanges slightly developed; posterior dorsal edge weakly wavy and its proximal end far posterior to distal ends of flanges.

Parasphenoid (Fig. 3, 13): alae inclined latero-posteriorly; neck of blade well-developed; distal end of posterior process posterior to level of both distal ends of alae.

Maxilla (Fig. 1, 39–40): dorsal process slightly developed; pterygoid process well-developed and projecting postero-medially; lingual shelf well-developed.

Scapula (Fig. 4, 5–6): center of anterior margin of body slightly convex; from dorsal view, ridge running along anterior margin of coracoid process from its proximal end to base and continues parallel with anterior margin of body; ridge well-developed.

Humerus (Fig. 6, 2): spina tuberculi medialis slightly present; distal end of medial epicondyle at same level as that of olecranon ball; lateral epicondyle projecting laterally; lateral flange small but present; in female, linear like ridge present instead of lateral flange; from anterior view, narrowest part of shaft present in slightly lower than one half of shaft; from medial view, ridge running between distal end of head and proximal end of spina tuberculi medialis; from posterior view, lateral margin of olecranon scar almost parallel with lateral margin of shaft; this olecranon scar projecting posteriorly.

Sacrum (Fig. 5, 5): diapophysis rod-like shaped and its cross section delta in shape; ridge lambdoid shaped and running along long axis of diapophysis to distal end; this ridge on neural arch at right angle from lateral view; angle between right and left ridges narrow compared to those of *R.* (*R?*) *namiyei* and *R.* (*R?*) *narina*; distance between both prezygapophyses short.

Ilium (Fig. 6, 34): ilial crest well-developed; dorsal protuberance well-developed and condition of it in Y type; ilial shaft angle at less than 45°.

Remarks: large sized frog. This species resembles *R.* (*B.*) *subaspera*. Only one specimen is available for study.

Rana (*Babina*) *subaspera* BARBOUR, 1908

Fronto-parietal (Fig. 1, 13): width slightly increases its width towards its proximal end; occipital process developed and tip of it at same level as posterior end of body; neck of medial posterior corner of orbital foramen slightly developed; supraorbital crest developed; parietal crest developed and contacts distal end of supraorbital crest; in adult specimen, both right and left bodies fused; figure of body resembles that of *R.* (*B.*) *holsti* except by ridge not running parallel with posterior margin of body.

Ethmoid (Fig. 2, 15–16): width of distal part of body slightly narrow compared to that of proximal one; anterior projection well-developed; processus lateralis projecting antero-laterally; both flanges developed; posterior ventral edge almost straight; proximal end of posterior dorsal edge far posterior to posterior end of flange; in adult specimen, fused with vomer.

Parasphenoid (Fig. 3, 12): anterior margin of alae perpendicular to blade; both distal ends of alae expanded antero-posteriorly; distal end of posterior process at same level as posterior ends of alae.

Maxilla (Fig. 1, 41–42): anterior end of pars facialis slightly convex; dorsal process projecting antero-dorsally; pterygoid process well-developed and projecting medio-

posteriorly; anterior one third of lingual shelf well-developed.

Scapula (Fig. 4, 7–8): anterior central margin (a distal of center part) convex; posterior margin of body strongly arches anteriorly; degree of this curvature stronger than that of *R.* (*B.*) *holsti*; from dorsal view, ridge running along anterior margin of coracoid process from its proximal end to base and continues parallel with anterior margin of body; general shape of this bone resembles that of *R.* (*B.*) *holsti* except by their size.

Humerus (Fig. 6, 1): spina tuberculi medialis present; intertubercular groove scarcely present; distal end of medial epicondyle extending below to that of olecranon ball; lateral epicondyle not projecting laterally; in male, lateral flange well-developed and extending distal two thirds of shaft and it projecting postero-laterally; in male, medial flange well-developed and extending distal one half of shaft and it projecting latero-posteriorly; width of medial flange wider than that of lateral flange; long axis of olecranon ball external to that of shaft; from medial view, ridge running between distal end of head and proximal end of spina tuberculi medialis; from posterior view, height of olecranon scar long compared to its width.

Sacrum (Fig. 5, 6): diapophysis rod-like in shape and anterior margin of it weak ridge in shape; ridge ∩ shaped and running across long axis of diapophysis to its distal end; this ridge slightly inclined anteriorly, above neural foramen and very weak on diapophyses; angle between right and left ridges more acute than that of *R.* (*R*?) *namiyei* and more obtuse than that of *R.* (*B.*) *holsti*; distance between both prezygapophyses longer than that of *R.* (*B.*) *holsti.*

Ilium (Fig. 6, 35): ilial crest well-developed; dorsal protuberance well-developed and condition of it in Y type; ilial shaft angle at about 45°; general shape of this bone resembles that of *R.* (*B.*) *holsti* except by their size and ilial shaft angle.

Remarks: large sized frog. It resembles *R.* (*B.*) *holsti.* One specimen is available for study.

Rana adenopleura BOULENGER, 1909

Fronto-parietal (Fig. 1, 3): width almost constant; neck of medial posterior corner of orbital foramen slightly developed.

Ethmoid (Fig. 2, 13–14): anterior projection well-developed; processus lateralis well projecting antero-laterally and distance between both its distal ends almost equal to body length; both orbitonasal foramina can be seen from below; both flanges slightly developed; posterior dorsal edge well-developed and wavy; its proximal end at same level as posterior ends of flange.

Parasphenoid (Fig. 3, 6): width of blade broad compared to its length; both distal ends of alae expanded antero-posteriorly; both ventral surfaces of distal ends of alae slightly depressed; neck of blade developed; tip of posterior process anterior to posterior ends of alae.

Maxilla (Fig. 1, 23–24): dorsal process poorly present; pterygoid process well-

developed; proximal one half of lingual shelf developed.

Scapula (Fig. 4, 23–24): from dorsal view, ridge running along anterior margin of coracoid process from its proximal end to base and continues parallel with anterior margin of body; figure of bone resembles that of *R.* (*R.*) *okinavana* except by degree of anterior curvature of body and width of body.

Humerus (Fig. 6, 21): spina tuberculi medialis present; intertubercular groove present; tip of medial epicondyle at same level as that of olecranon ball; size of olecranon ball large compared to that of shaft; long axis of olecranon ball external to that of shaft; shaft strongly arches anteriorly; ventral crest weakly developed and anterior margin of ventral crest almost straight; from posterior view, lateral margin of olecranon scar contacts lateral margin of shaft.

Sacrum (Fig. 5, 8): diapophysis rod-like in shape and slightly expanded at distal end; ridge ∩ shaped and running to distal ends of diapophyses; this ridge weakly developed on diapophyses; both prezygapophyses well-developed and extending anterior to anterior end of centrum.

Ilium (Fig. 6, 24): ilial crest developed and thin; dorsal protuberance well-developed and condition of it in Y type; base of ilial shaft contacts anterior end of acetabular fossa; angle between posterior margin of dorsal protuberance and dorsal margin of dorsal acetabular expansion narrower than that of *R.* (*R.*) *limnocharis*; ilial shaft angle at less than 45°.

Remarks: small sized frog. One specimen is available for study.

Discussion and Conclusion

There are seventeen species of the genus *Rana* distributed throughout Japan and adjacent areas. The taxonomy of the subgenus *Rana*, however, remains controversial. NAKAMURA et UÉNO (1963) divided the genus *Rana* in Japan into three subgenera, *Rana* (*Rana*), *Rana* (*Babina*), and *Rana* (*Rana*?). OKADA (1930), however, treated *Babina* as an independent genus. Osteologically, I have found no differences at the generic level between *Rana* (*Rana*) and *Rana* (*Babina*). *Babina* has a sharply pointed spinous phalanx of the first finger and no longitudinal dorsal folds, but these characters appear to be secondary. Or the same reasons mentioned above, it is not reasonable osteologically to recognize the subgenus *Rana* (*Rana*?).

Osteologically, the genus *Rana* is differentiated from other Japanese frogs and toads.

Fronto-parietal (Fig. 1, 1–14): neither dermal ornamentation nor supraorbital crest present; width narrow; no occipital canal present; posterior process present.

Ethmoid (Fig. 2, 1–28): longer than width; anterior projection scarcely developed; posterior dorsal edge arches anteriorly.

Parasphenoid (Fig. 3, 1–14): blade longer than its width across alae; both distal ends of alae expanded antero-posteriorly.

Maxilla (Fig. 1, 15–42): teeth present; dorsal process developed and projecting

dorsally; pterygoid process present; no particular difference present between *Rana* and *Rhacophorus*.

Scapula (Fig. 4, 12–28): anterior margin of clavicular process concave; ridge running along anterior margin of coracoid process.

Humerus (Fig. 6, 1–21): spina tuberculi medialis present; width broader than that of *Rhacophorus*; long axis of olecranon ball matches with that of shaft; outline of olecranon scar seen clearly visible.

Sacrum (Fig. 5, 1–14): anterior surface of centrum convex; diapophysis rod-like in shape.

Ilium (Fig. 6, 22–35): ilial crest well-developed; antero-postero length of ventral acetabular expansion narrow.

Femur (Fig. 5, 15): no deltoid crest present.

Summary

Disarticulated skeletons of about 160 individuals belonging to 24 species in 6 genera of Japanese frogs and toads were studied.

The materials included representatives of the following genera: *Bufo*, 3 species; *Rana*, 14 species; *Rhacophorus*, 6 species; *Hyla*, 1 species; *Microhyla*, 1 species; *Bombina*, 1 species.

The fronto-parietal, ethmoid, parasphenoid, maxilla, scapula, humerus, sacrum, and ilium were examined in specimens of *Bufo*, *Rana*, *Rhacophorus*, *Hyla*, *Microhyla*, and *Bombina*. It was found that these genera can be distinguished from each other by differences in the bones mentioned above. At the species level, those belonging to *Bufo*, *Rana*, and *Rhacophorus* were also distinguishable from each other by the bones mentioned above.

The important osteological characters of the frogs and toads are summarized below.

Fronto-parietal: ornamentation present on dorsal surface in *Bufo*, no sculpture present in *Rana*, *Rhacophorus*, *Hyla*, *Microhyla*, and *Bombina*; width narrow compared to its length in *Bufo*, *Rana*, *Hyla*, and *Bombina*, broad in *Rhacophorus* and *Microhyla*; occipital process not usually projecting, except for strongly projecting in *Rana*; postorbital shelf usually present in *Rana*, *Microhyla*, and *Bufo*; in adult specimens, in *Bufo*, fused with prootics; supraorbital crest present in *Bufo*.

Ethmoid: width broad compared to its length in *Bufo*, *Rhacophorus*, and *Hyla*, narrow in *Rana*, almost equal in *Bombina*; body divided into two elements in *Microhyla*; anterior projection developed in *Rhacophorus* but usually weakly developed in *Bufo*, *Rana*, and *Bombina*, not present in *Hyla* and *Microhyla*; processus lateralis projecting strongly in *Bufo*, *Hyla*, *Microhyla*, and *Bombina*, weakly in *Rana* and *Rhacophorus*; proximal end of posterior dorsal edge posterior to posterior ends of flanges in *Bufo* and *Rana*, same in *Rhacophorus*, *Hyla*, and *Bombina*.

Parasphenoid: blade longer than its width across alae in *Rana*, *Hyla*, *Microhyla*, and *Bombina*, almost equal in *Bufo* and *Rhacophorus*; ridge present on long axis of alae

in *Bufo*, absent in *Rana*, *Rhacophorus*, *Hyla*, *Microhyla*, and *Bombina*; alae perpendicular to blade in *Bufo*, *Hyla*, and *Microhyla*, variable in *Rana*, *Rhacophorus*, and *Bombina*; antero-postero length of alae short in *Rhacophorus*, *Hyla*, and *Microhyla*, broad and expanded in *Bufo* and *Rana*, broad and constant in *Bombina*.

Maxilla: teeth present in *Rana*, *Rhacophorus*, and *Bombina*, not in *Bufo*, *Hyla*, and *Microhyla*; lingual shelf developed in *Bufo*, *Rana*, *Microhyla*, and *Bombina*, weakly developed in *Rhacophorus* and *Hyla*; dorsal process weakly developed in *Bufo* and *Hyla*, biconvex in *Bombina*; in *Rana* and *Rhacophorus*, dorsal process variable in size and shape; pterygoid process well-developed in *Bufo* and *Bombina*, variable in size in *Rana*, *Rhacophorus*, and *Hyla*, absent in *Microhyla*.

Scapula: anterior margin of clavicular process convex anteriorly in *Bufo*, *Rhacophorus*, concave posteriorly in *Rana* and *Hyla*; foramen present in *Bufo* and *Hyla*; ridge running along anterior margin of coracoid process in *Rana* and *Microhyla*, along center of it in *Bufo*, *Rhacophorus*, *Hyla*, and *Bombina*; neck of body well-developed; antero-postero length of body short in *Rhacophorus* and *Hyla*.

Humerus: spina tuberculi medialis well-developed in *Bufo* and *Bombina*, developed in *Rana*, weakly developed in *Rhacophorus*, absent in *Hyla* and *Microhyla*; long axis of olecranon ball external to that of shaft in *Bufo*, *Rhacophorus*, *Hyla*, and *Bombina*, matches with that of shaft in *Rana* and *Microhyla*; lateral flange developed in *Bufo*, *Rhacophorus*, and *Bombina*; in *Rana*, lateral flange sometimes developed in male; medial flange developed in males of *Bufo*, *Rana*, *Rhacophorus*, *Hyla*, and *Bombina*; in *Microhyla*, both flanges lacking; outline of olecranon scar clear in *Bufo*, *Rana*, *Hyla*, and *Bombina*, indistinct in *Rhacophorus* and *Microhyla*; width of shaft narrow compared to its length in *Rhacophorus*, broad in *Bufo*, *Rana*, *Hyla*, *Microhyla*, and *Bombina*; distal end of medial epicondyle projecting less than that of olecranon ball in *Rhacophorus*, at same level in *Hyla*, *Microhyla*, and *Bombina*, same or below in *Rana*, variable in *Bufo*.

Sacrum: anterior surface of centrum concave in *Bufo*, *Rhacophorus*, and *Hyla*, convex in *Rana*, *Microhyla*, and *Bombina*; diapophyses expanded in *Bufo*, *Hyla*, *Microhyla*, and *Bombina*, rod-like in shape in *Rana* and *Rhacophorus*; ridge well-developed and running on diapophyses in *Rana* and *Rhacophorus*, scarcely running in *Bufo*, *Hyla*, and *Microhyla*, not in *Bombina*; ridge running in variable directions in *Rana*.

Ilium: ilial crest developed in *Rana*, *Rhacophorus*, and *Hyla*, absent in *Bufo*, *Microhyla*, and *Bombina*; antero-postero length of ventral acetabular expansion broad in *Rhacophorus* and *Hyla*, narrow in *Bufo*, *Rana*, *Microhyla*, and *Bombina*; ilial shaft angle variable in *Rana* and *Rhacophorus*; deltoid dorsal protuberance present in *Microhyla*.

Femur: deltoid crest developed in *Bufo*, *Rhacophorus*, *Hyla*, and *Bombina*, absent in *Rana* and *Microhyla*.

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Explanation of figures

Fig. 1. Right fronto-parietal (Dorsal view). 1, *Rana* (*Rana*) *tagoi*, "Tagogaeru". 2, *Rana* (*Rana*) *okinavana*, "Ryûkyûakagaeru". 3, *Rana adenopleura*, "Harabuchigaeru". 4, *Rana* (*Rana*) *limnocharis limnocharis*, "Numagaeru". 5, *Rana* (*Rana*) *chensinensis dybowskii*, "Ezoakagaeru". 6, *Rana* (*Rana*) *ornativentris*, "Yamaakagaeru". 7, *Rana* (*Rana*) *japonica*, "Nihonakagaeru". 8, *Rana* (*Rana*?) *narina*, "Hanasakigaeru". 9, *Rana* (*Rana*) *nigromaculata*, "Tonosamagaeru". 10, *Rana* (*Rana*?) *ishikawae*, "Ishikawagaeru". 11, *Rana* (*Rana*?) *namiyei*, "Namiegaeru". 12, *Rana* (*Babina*) *holsti*, "Horustogaeru". 13, *Rana* (*Babina*) *subaspera*, "Ottongaeru". 14, *Rana* (*Rana*) *rugosa*, "Tsuchigaeru". A scale indicates 1 mm.

Right maxilla (Odd number; medial view, even number; lateral view). 15, 16, *Rana* (*Rana*) *japonica*, "Nihonakagaeru". 17, 18, *Rana* (*Rana*) *nigromaculata*, "Tonosamagaeru". 19, 20, *Rana* (*Rana*?) *narina*, "Hanasakigaeru". 21, 22, *Rana* (*Rana*) *ornativentris*, "Yamaakagaeru". 23, 24, *Rana adenopleura*, "Harabuchigaeru". 25, 26, *Rana* (*Rana*) *chensinensis dybowskii*, "Ezoakagaeru". 27, 28, *Rana* (*Rana*) *tagoi*, "Tagogaeru". 29, 30, *Rana* (*Rana*) *okinavana*, "Ryûkyûakagaeru". 31, 32, *Rana* (*Rana*) *rugosa*, "Tsuchigaeru". 33, 34, *Rana* (*Rana*) *limnocharis limnocharis*, "Numagaeru". 35, 36, *Rana* (*Rana*?) *ishikawae*, "Ishikawagaeru". 37, 38, *Rana* (*Rana*?) *namiyei*, "Namiegaeru". 39, 40, *Rana* (*Babina*) *holsti*, "Horustogaeru". 41, 42, *Rana* (*Babina*) *subaspera*, "Ottongaeru". A scale indicates 2 mm.

Fig. 2. Ethmoid (Odd number; dorsal view, even number; ventral view). 1, 2, *Rana* (*Rana*) *chensinensis dybowskii*, "Ezoakagaeru". 3, 4, *Rana* (*Rana*) *okinavana*, "Ryûkyûakagaeru". 5, 6, *Rana* (*Rana*) *ornativentris*, "Yamaakagaeru". 7, 8, *Rana* (*Rana*) *rugosa*, "Tsuchigaeru". 9, 10, *Rana* (*Rana*) *tagoi*, "Tagogaeru". 11, 12, *Rana* (*Rana*) *limnocharis limnocharis*, "Numagaeru". 13, 14, *Rana adenopleura*, "Harabuchigaeru". 15, 16, *Rana* (*Babina*) *subaspera*, "Ottongaeru". 17, 18, *Rana* (*Babina*) *holsti*, "Horustogaeru". 19, 20, *Rana* (*Rana*?) *namiyei*, "Namiegaeru". 21, 22, *Rana* (*Rana*?) *narina*, "Hanasakigaeru". 23, 24, *Rana* (*Rana*?) *ishikawae*, "Ishikawagaeru". 25, 26, *Rana* (*Rana*) *nigromaculata*, "Tonosamagaeru". 27, 28, *Rana* (*Rana*) *japonica*, "Nihonakagaeru". A scale indicates 1 mm. For all figures, the anterior is to the left.

Fig. 3. Parasphenoid (Ventral view). 1, *Rana* (*Rana*) *ornativentris*, "Yamaakagaeru". 2, *Rana* (*Rana*) *rugosa*, "Tsuchigaeru". 3, *Rana* (*Rana*) *chensinensis dybowskii*, "Ezoakagaeru". 4, *Rana* (*Rana*) *tagoi*, "Tagogaeru". 5, *Rana* (*Rana*) *okinavana*, "Ryûkyûakagaeru". 6, *Rana adenopleura*, "Harabuchigaeru". 7, *Rana* (*Rana*) *limnocharis limnocharis*, "Numagaeru". 8, *Rana* (*Rana*) *japonica*, "Nihonakagaeru". 9, *Rana* (*Rana*) *nigromaculata*, "Tonosamagaeru". 10, *Rana* (*Rana*?) *narina*, "Hanasakigaeru". 11, *Rana* (*Rana*?) *ishikawae*, "Ishikawagaeru". 12, *Rana* (*Babina*) *subaspera*, "Ottongaeru". 13, *Rana* (*Babina*) *holsti*, "Horustogaeru". 14, *Rana* (*Rana*?) *namiyei*, "Namiegaeru". A scale indicates 1 mm.

Fig. 4. Right scapula (Odd number; dorsal view, even number; ventral view). 1, 2, *Rana* (*Rana*) *rugosa*, "Tsuchigaeru". 3, 4, *Rana* (*Rana*?) *namiyei*, "Namiegaeru". 5, 6, *Rana* (*Babina*) *holsti*, "Horustogaeru". 7, 8, *Rana* (*Babina*) *subaspera*, "Ottongaeru". 9, 10, *Rana* (*Rana*) *okinavana*, "Ryûkyûakagaeru". 11, 12, *Rana* (*Rana*) *limnocharis limnocharis*, "Numagaeru". 13, 14, *Rana* (*Rana*) *chensinensis dybowskii*, "Ezoakagaeru". 15, 16, *Rana* (*Rana*) *tagoi*, "Tagogaeru". 17,18, *Rana* (*Rana*) *nigromaculata*, "Tonosamagaeru". 19, 20, *Rana* (*Rana*?) *ishikawae*, "Ishikawagaeru". 21, 22, *Rana* (*Rana*) *ornativentris*, "Yamaakagaeru". 23, 24, *Rana adenopleura*, "Harabuchigaeru". 25, 26, *Rana* (*Rana*?) *narina*, "Hanasakigaeru". 27, 28, *Rana* (*Rana*) *japonica*, "Nihonakagaeru". A scale indicates 1 mm.

Fig. 5. Sacrum (Dorsal view). 1, *Rana* (*Rana*?) *narina*, "Hanasakigaeru". 2, *Rana* (*Rana*) *japonica*, "Nihonakagaeru". 3, *Rana* (*Rana*?) *ishikawae*, "Ishikawagaeru". 4, *Rana* (*Rana*?) *namiyei*, "Namiegaeru". 5, *Rana* (*Babina*) *holsti*, "Horustogaeru". 6, *Rana* (*Babina*) *subaspera*, "Ottongaeru". 7, *Rana* (*Rana*) *nigromaculata*, "Tonosamagaeru". 8, *Rana adenopleura*, "Harabuchigaeru". 9, *Rana* (*Rana*) *rugosa*, "Tsuchigaeru". 10, *Rana* (*Rana*) *ornativentris*, "Yamaakagaeru". 11, *Rana* (*Rana*) *chensinensis dybowskii*, "Ezoakagaeru". 12, *Rana* (*Rana*) *okinavana*, "Ryûkyûakagaeru". 13, *Rana* (*Rana*) *limnocharis limnocharis*, "Numagaeru". 14, *Rana* (*Rana*) *tagoi*, "Tagogaeru". A scale indicates 2 mm.

Right femur (Anterior view). 15, *Rana*, "Akagaeru". A scale indicates 2 mm.

Fig. 6. Right humerus (Anterior view). 1, *Rana* (*Babina*) *subaspera*, "Ottongaeru", male. 2, *Rana* (*Babina*) *holsti*, "Horustogaeru", female. 3, *Rana* (*Rana*?) *namiyei*, "Namiegaeru", female. 4, *Rana* (*Rana*?) *ishikawae*, "Ishikawagaeru", male. 5, *ditto*, female. 6, *Rana* (*Rana*) *nigromaculata*, "Tonosamagaeru", male. 7, *ditto*, female. 8, *Rana* (*Rana*?) *narina*, "Hanasakigaeru", male. 9, *ditto*, female. 10, *Rana* (*Rana*) *chensinensis dybowskii*, "Ezoakagaeru", male. 11, *ditto*, female. 12, *Rana* (*Rana*) *japonica*, "Nihonakagaeru", female. 13, *Rana* (*Rana*) *ornativentris*, "Yamaakagaeru", male. 14, *ditto*, female. 15, *Rana* (*Rana*) *tagoi*, "Tagogaeru", male. 16, *ditto*, female. 17, *Rana* (*Rana*) *rugosa*, "Tsuchigaeru", male. 18, *ditto*, female. 19, *Rana* (*Rana*) *okinavana*, "Ryûkyûakagaeru", female. 20,

Rana (*Rana*) *limnocharis limnocharis*, "Numagaeru", female. 21, *Rana adenopleura*, "Harabuchigaeru", female. A scale indicates 1 mm.

Right ilium (Lateral view). 22, *Rana* (*Rana*) *tagoi*, "Tagogaeru". 23, *Rana* (*Rana*) *okinavana*, "Ryûkyûakagaeru". 24, *Rana adenopleura*, "Harabuchigaeru". 25, *Rana* (*Rana*) *chensinensis dybowskii*, "Ezoakagaeru". 26, *Rana* (*Rana*) *rugosa*, "Tsuchigaeru". 27, *Rana* (*Rana*) *limnocharis limnocharis*, "Numagaeru". 28, *Rana* (*Rana*?) *narina*, "Hanasakigaeru". 29, *Rana* (*Rana*) *nigromaculata*, "Tonosamagaeru". 30, *Rana* (*Rana*) *japonica*, "Nihonakagaeru". 31, *Rana* (*Rana*) *ornativentris*, "Yamaakagaeru". 32, *Rana* (*Rana*?) *ishikawae*, "Ishikawagaeru". 33, *Rana* (*Rana*?) *namiyei*, "Namiegaeru". 34, *Rana* (*Babina*) *holsti*, "Horustogaeru". 35, *Rana* (*Babina*) *subaspera*, "Ottongaeru". A scale indicates 3 mm.

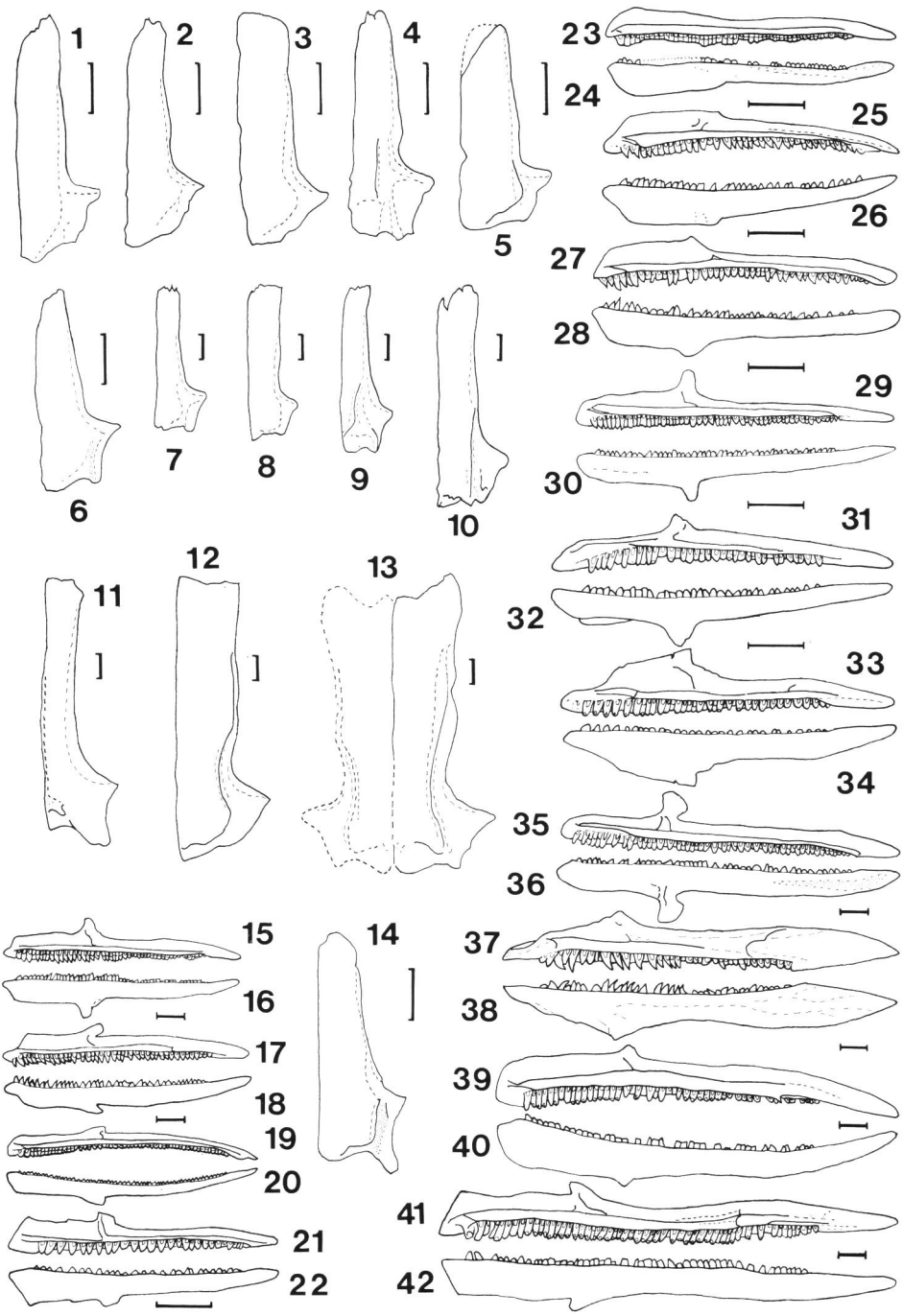

Fig. 1. Right fronto-parietal, and right maxilla.

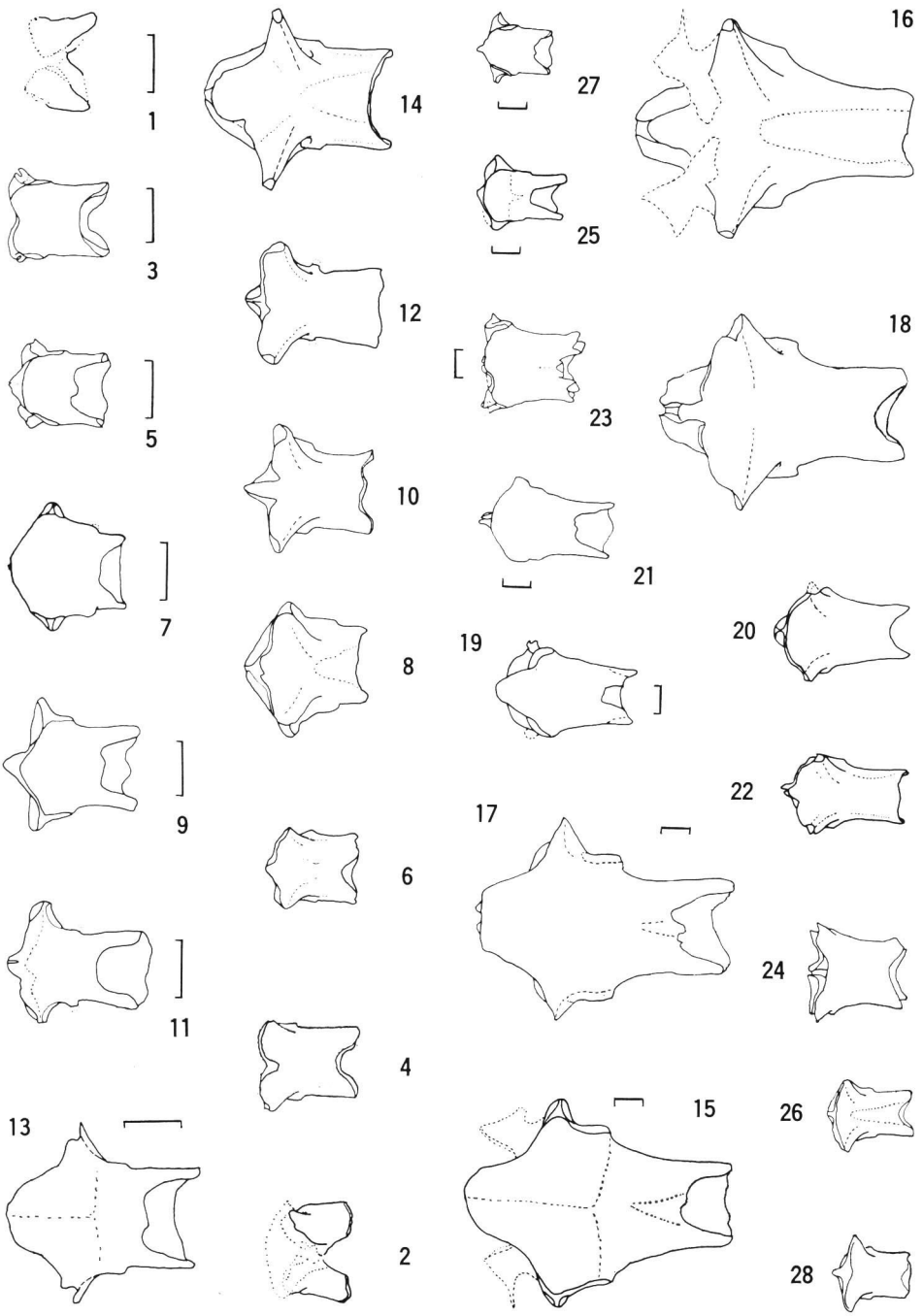

Fig. 2. Ethmoid.

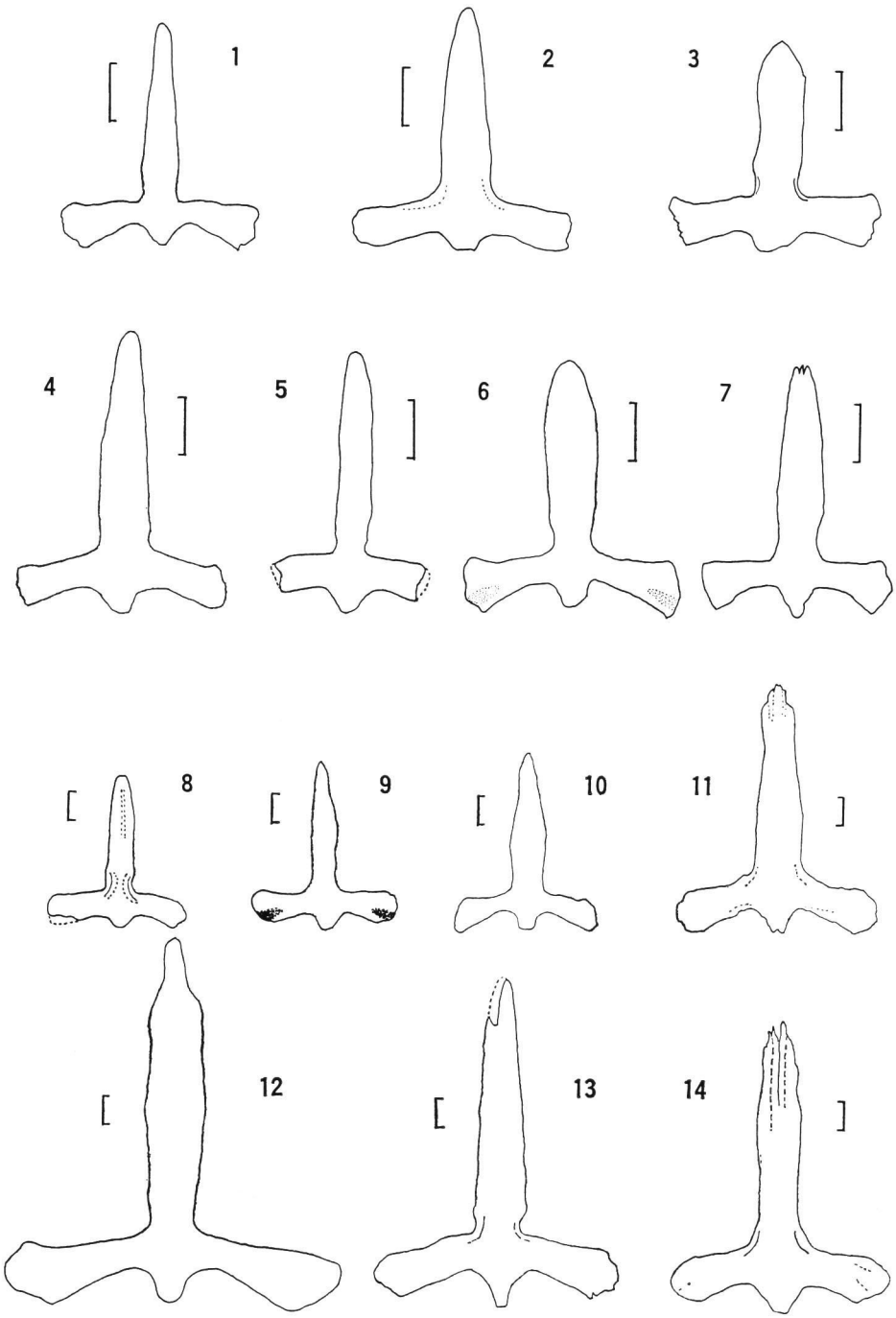

Fig. 3. Parasphenoid.

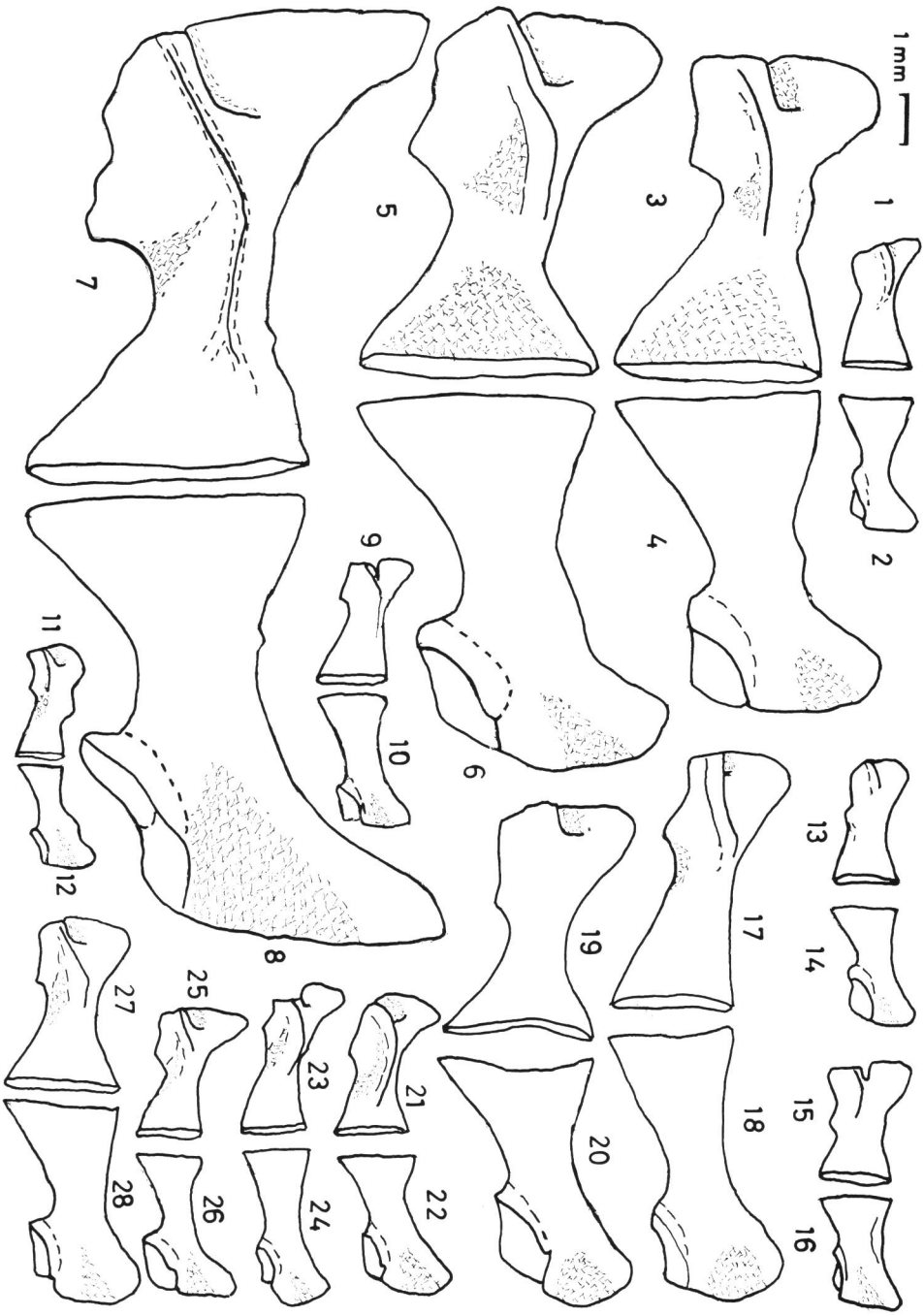

Fig. 4. Right scapula.

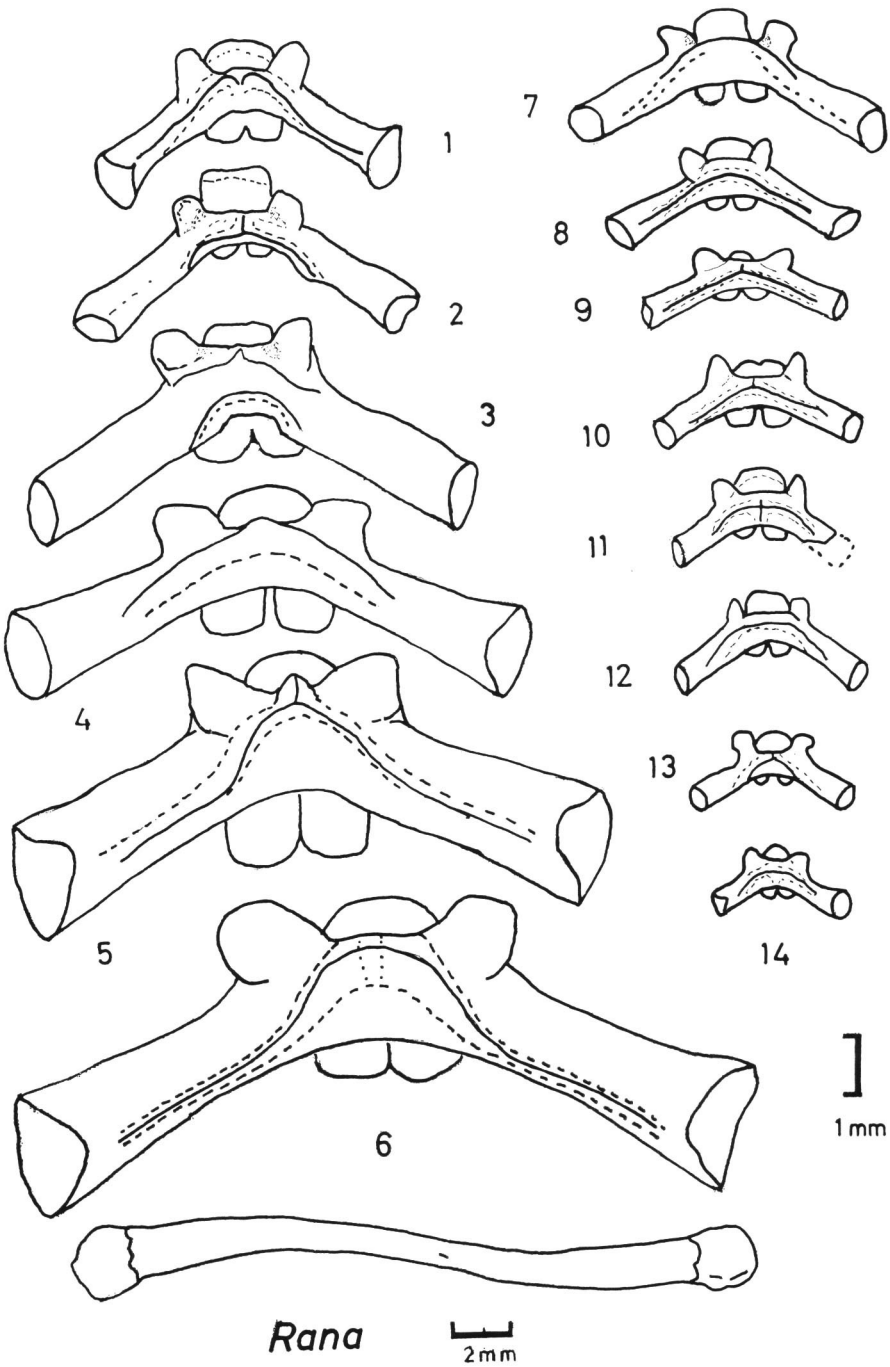

Fig. 5. Sacrum and right femur.

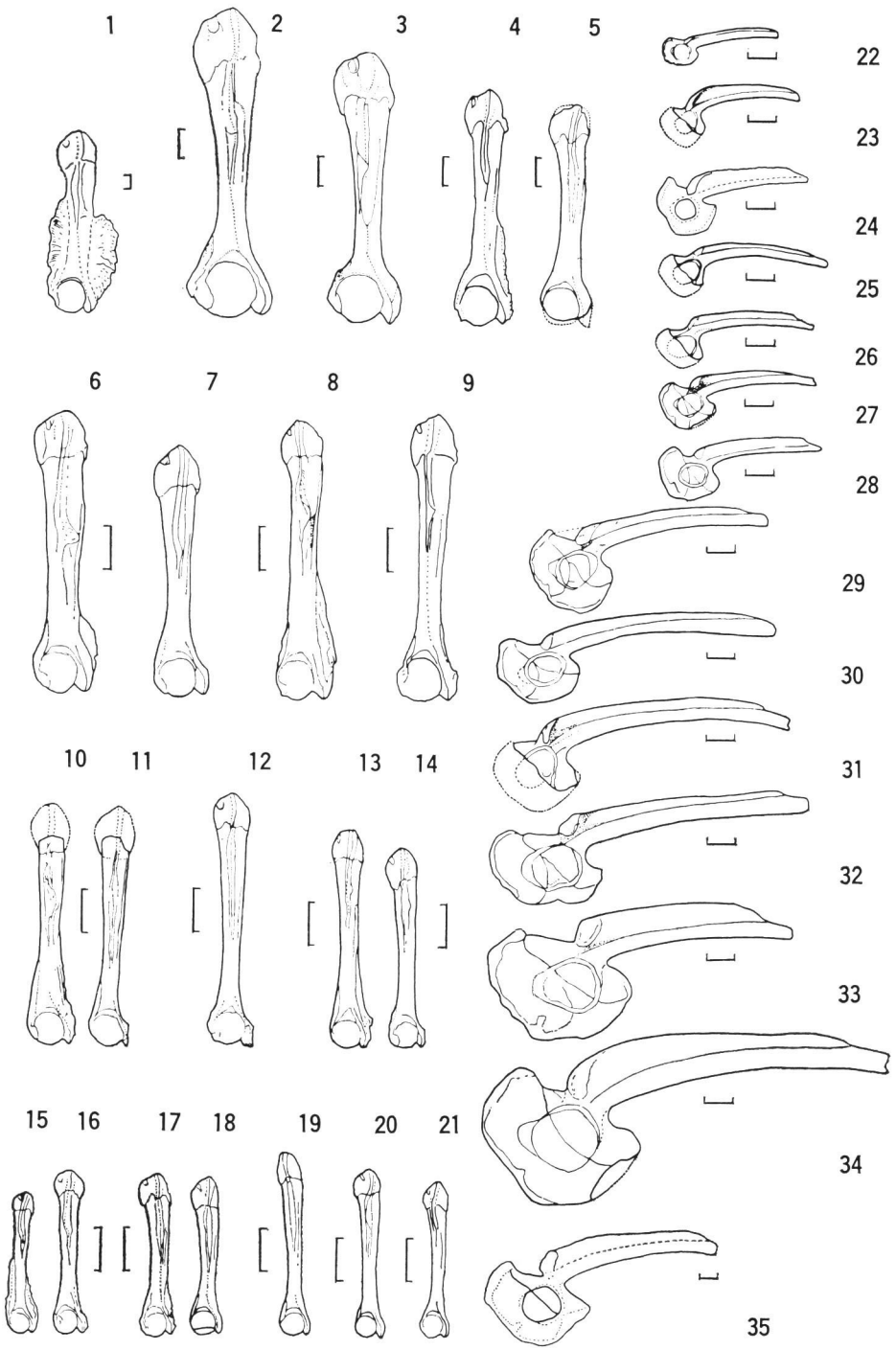

Fig. 6. Right humerus and right ilium.