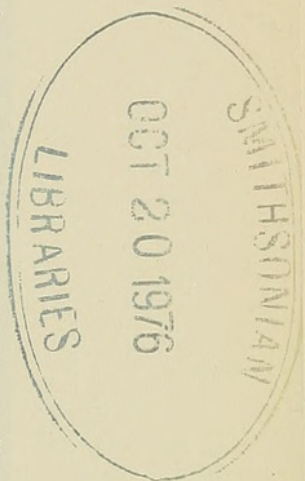


PROCEEDINGS
OF THE
BIOLOGICAL SOCIETY OF WASHINGTON

PRELIMINARY DIAGNOSES OF TWO
EXTRAORDINARY NEW GENERA OF BIRDS FROM
PLEISTOCENE DEPOSITS IN THE
HAWAIIAN ISLANDS

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Since 1971, the Bernice P. Bishop Museum (BBM) of Honolulu, Hawaii, has been forwarding to the Smithsonian Institution large numbers of fossil bird bones for identification and study. Most of this material is from dunes of Pleistocene age on the island of Molokai. Stearns (1973) has written an account of the geology of these fossil deposits. A few of the specimens were taken from a lava tunnel on the neighboring island of Maui. The avifauna represented is quite varied and contains many undescribed species. Two of these birds are so anomalous as to have excited a fair amount of popular attention (Anonymous, 1972a, 1972b, 1974; Benson 1972, 1973; Pratt, 1972; and United Press International releases appearing in many mainland newspapers), with illustrations of specimens of one of the species already having been published. The Bishop Museum is planning public displays featuring these much-publicized fossil birds.

A complete account of all the fossil birds will require some time for preparation due to the extent of the material so far collected. It is desirable to describe the two well-publicized forms at this time. A more complete discussion of the affinities and morphology of these forms will appear at a later date.

THRESKIORNITHIDAE
Apteribis, new genus

Type: Apteribis glenos, new species.

Diagnosis: A rather small ibis with much reduced wings and pec-

toral girdle and virtually keelless sternum; hindlimb elements proportionately much shorter and heavier than in any other known member of the family. Tarsometatarsus short and broad, distal foramen small, hypotarsus narrow with 2 nearly equally developed ridges and an intervening groove but with no closed canal. Tibiotarsus short with heavy shaft; inner and outer cnemial crests notably better developed than in living genera, the former being more deeply excavated on the internal side. Femur with rotular groove very wide and deep, neck more elongate, head less bulbous and more distinctly set off from shaft than in other ibises. Scapula small, strongly curved, acromion reduced. Coracoid small, coraco-humeral surface much reduced, with details indistinct, procoracoid reduced, apparently not much curved but with foramen still present. Humerus reduced and twisted, deltoid crest very small and produced distally in a bulbous knob, head low, external tuberosity much reduced. Sternum with 4 shallow notches, carina only a slight ridge, coracoidal sulci widely separated, spina externa absent, costal facets indistinct. Mandible narrow, with dorsal and ventral median groove typical of ibises, flattened dorsally, decurved, not constricted at base of symphysis as in *Threskiornis*, nor very narrow as in *Hagedashia*.

Etymology: Gr. *a-*, privative prefix, *pteron*, wing and *ibis*, f. a wading bird, an ibis—in allusion not only to the reduced wings of the bird, but also to the resemblance of the proportions of the hindlimb to those of *Apteryx*, the kiwi of New Zealand.

***Apteribis glenos*, new species**

Figures 1–3

Holotype: Complete right tarsometatarsus BBM-X 147986. Collected in spring, 1975, by Joan Aidem, 2.0 miles west of Moomomi Beach northwestern coast of Molokai, Hawaiian Islands (collector's site No. 6, about 23 m elevation, 140 m from ocean).

Measurements of holotype: Length 55.4 mm, proximal width 13.1, proximal depth 12.3, least width of shaft 11.9, distal width 13.7, depth through trochleae 9.9, width of middle trochlea 5.3.

Paratypes: Left tarsometatarsus BBM-X 146485, left tibiotarsus 146484, right femur 146482, right humerus 147240, left scapula 146530, fragment of rostrum 146543, all from the same immediate locality as the holotype and very likely from the same individual since the paratype tarsometatarsus is identical in size to the holotype. Also, 49 bones or fragments of bone (BBM-X 147127–147175) from Lower Waihoi Valley Cave, approximately 425 m elevation, about 3 miles south of Hana, Maui, Hawaiian Islands, collected 20 March 1974 by W. C. Gagné and B. C. Harrison. These appear to be from a single individual and include the following: sternum, complete right femur and tibiotarsus, right tarsometatarsus (2 pieces); left femur, tibiotarsus and tarsometatarsus (6 pieces total); right and left

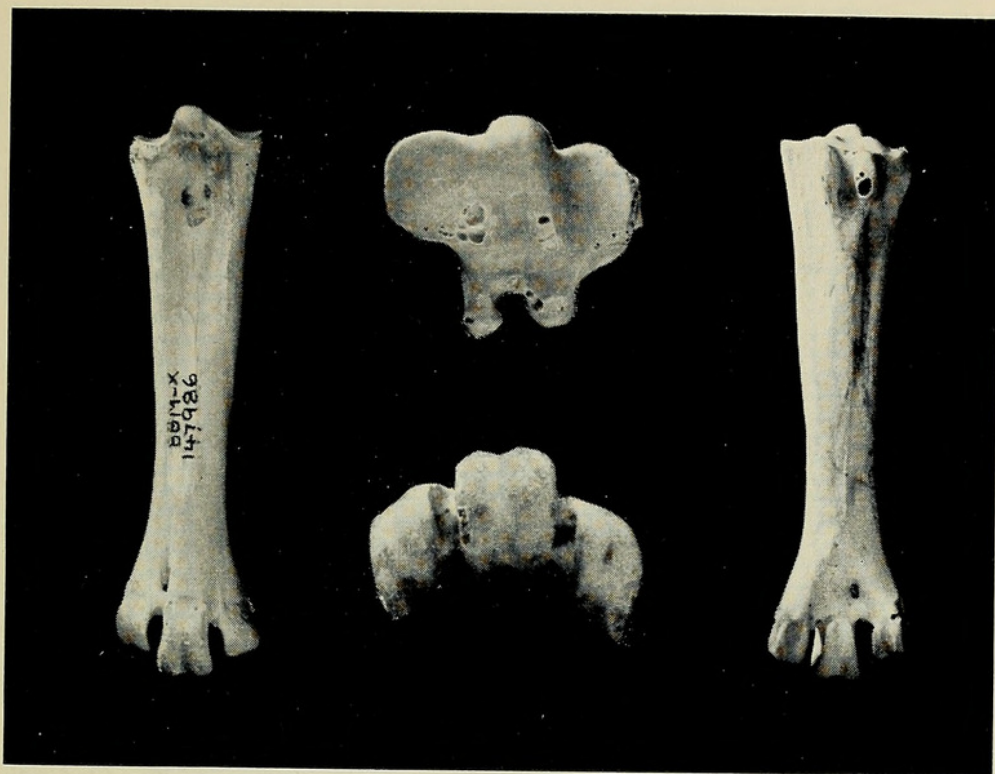


FIG. 1. *Apteribis glenos*, new genus and species, holotype right tarsometatarsus BBM-X 147986, anterior, proximal, distal, and posterior views. End views 2 \times , others 1 \times .

humeri (3 pieces total); 6 pedal phalanges; 4 fragments of pelvis; a proximal fragment of radius; a distal fragment of ulna; a fragment of clavicle; incomplete right coracoid; 10 vertebrae; 6 fragments of ribs; 4 fragments of mandible; and a right quadrate. The hindlimb elements of this specimen are somewhat more slender than those from Molokai but the differences appear to be due to individual variation only. A few other specimens from Molokai are referable to this species, but as most of them have not yet been cleaned and are less perfect, they have not been considered here.

Measurements of paratypes: Molokai specimens—length of tibiotarsus 98.4 mm, length of femur 63.5, length of humerus 65.5, length of scapula 42.8. Maui specimen—length of femur 63.8 mm, length of tibiotarsus 101.0, length of sternum through midline 43.6, width of sternum at anterior costal facet 27.7.

Age: The age of the precise locality on Molokai from which the ibis specimens were taken has not been determined. A nearby dune site yielding the holotype of the goose described beyond is reported to be about 25,000 years old (Stearns, 1973). However, the ibis bones appear to be less mineralized than the goose specimen and may be younger.



FIG. 2. *Apteribis glenos*, new genus and species, paratype pectoral and cranial elements. Left to right and top to bottom: sternum BBM-X 147132 (ventral view); right coracoid BBM-X 147133 (ventral); left scapula BBM-X 146530 (dorsal); right humerus BBM-X 147240 (anconal); fragment of rostrum BBM-X 146543 (right lateral); two fragments of mandible, the distal portion turned dorsally to show groove, BBM-X 147129 and 147128. Reduced about 20%.

The bones from the Maui lava tunnel are unmineralized, friable, and probably comparatively recent in age.

Diagnosis: As for the genus.

Etymology: Gr. *glēnos*, a thing to stare at, a wonder. The specific name is a neuter noun in apposition.

Remarks: *Apteribis* is remarkable in being the only ibis known from Oceania, apart from *Threskiornis aethiopicus pygmaeus* Mayr from Rennell Island in the Solomons, and also in being the only certainly flightless member of the order Ciconiiformes. Contrary to Hachisuka (1937), the morphology of the fossil heron of Rodrigues Island in the Indian Ocean (*Nycticorax megacephalus*) does not seem to indicate that it was entirely flightless, as the sternal carina was still fairly well developed and the wing elements were not greatly reduced.

The hindlimb of *Apteribis* is so modified from that of typical ibises as almost to defy identification. At first we had only the femur, tibiotarsus, and tarsometatarsus to work with, and of all modern birds the proportions of these elements most closely approached those of

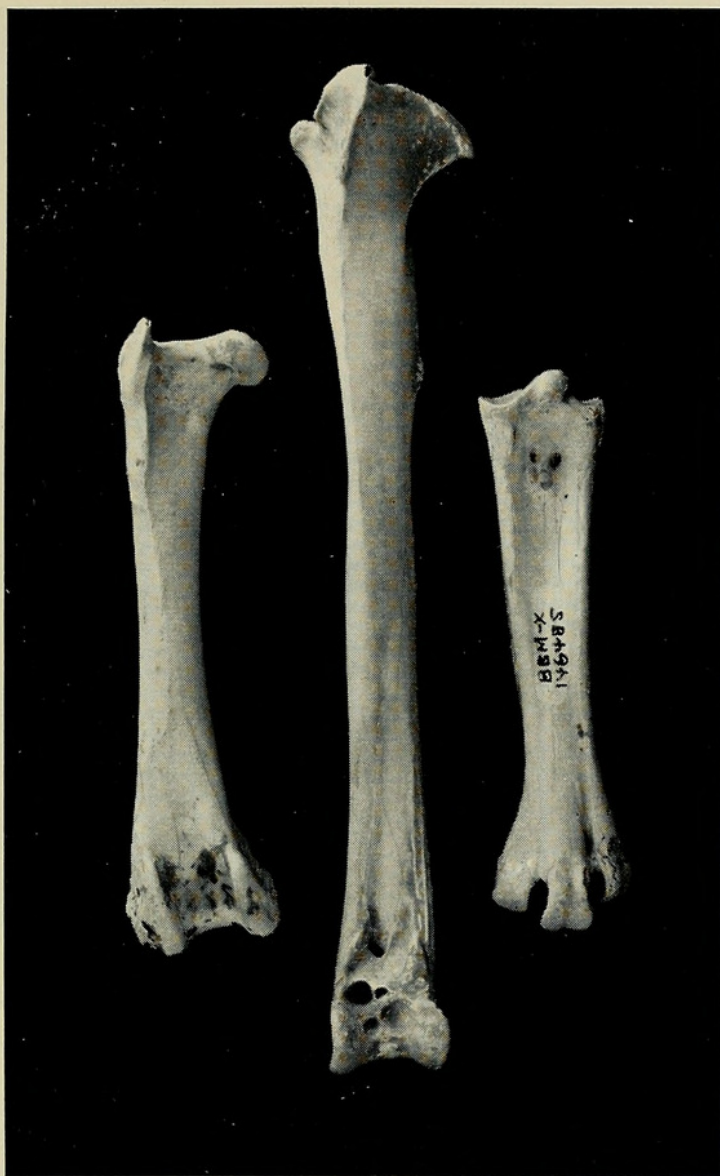


FIG. 3. *Apteribis glenos*, new genus and species, paratype hindlimb elements in anterior view: right femur BBM-X 146482, left tibiotarsus BBM-X 146484, left tarsometatarsus BBM-X 146485. Natural size.

the kiwis (*Apteryx*, *Apterigidae*), although there are a number of differences between the two. After prolonged comparisons with an extensive series of modern bird skeletons we were able to identify the hindlimb of *Apteribis* only tentatively as that of an ibis, and it was not until we received the associated material from Maui, including fragments of mandible, that our suspicions were confirmed. *Apteribis* is so modified from its ancestral stock that it would be fruitless to speculate on its origins at this time.

ANATIDAE

Thambetochen, new genus

Type: Thambetochen chaulioudous, new species.

Diagnosis: A large, flightless goose with heavy hindlimbs, minute wings, and keelless sternum. Distinguished from all other members of the family by possessing blunt, bony, toothlike projections on both jaws. Ventral surface of rostrum with 2 pronounced ridges separated by a deep median groove. Mandibular symphysis long and tapering, dentary portion of mandible very heavy, with an expanded lateral ridge, contrasting sharply with the posterior portions of the rami which are weak and delicate. Clavicles apparently absent. Coracoid with entire acrocoracoid absent, there being nothing above the level of the glenoid facet; scapular facet perpendicular to the shaft. Wings extremely small; digits I and III probably lacking. Sternum with virtually no trace of a carina and with the posterior two-thirds not fused along the midline; 2 large notches in posterior border. Pelvis heavy, posterior portions of ilia very deep and expanded laterally. Femur with flattened trochanter, lacking the proximal crest; head elevated above trochanter; external condyle not greatly produced distally as in *Cnemiornis*. Tibiotarsus heavy, much expanded proximally; outer cnemial crest broad and thick; fibular crest indistinct. Tarsometatarsus squat; inner cotyla much larger and deeper than outer; intercotylar prominence high; inner tendinal groove of hypotarsus not closed.

Etymology: Gr. *thambētos*, astonishing, and *chēn*, m. goose.

Thambetochen chaulioudous, new species

Figures 4-6

Holotype: Associated skeleton BBM-X 146029. From sand dune 1.7 miles west of Moomoni Beach, northwestern coast of Molokai, Hawaiian Islands (collector's site No. 1; about 3 m elevation, 45 m from ocean). The skull and some cervical vertebrae were collected by Joan Aidem and the remainder of the skeleton was collected later by A. C. Ziegler. The specimen consists of the skull, lacking the interorbital area, so that the braincase is detached from the rostrum; mandible; both quadrates; both pterygoids; most or all of the hyoid bones; axis and 9 other cervical vertebrae; the first 10 vertebrae anterior to the synsacrum, with their vertebral and sternal ribs and uncinat processes; complete pelvis; seven caudal vertebrae and part of an eighth (the pygostyle?) both coracoids and scapulae; both wings (each with only 1 free carpal and lacking digits I and III); both hindlimbs, the right with 6 associated phalanges, the left lacking phalanges; 1 ungual phalanx; pieces of tracheal rings and other fragments. Pieces of eggshell directly associated with the holotype may

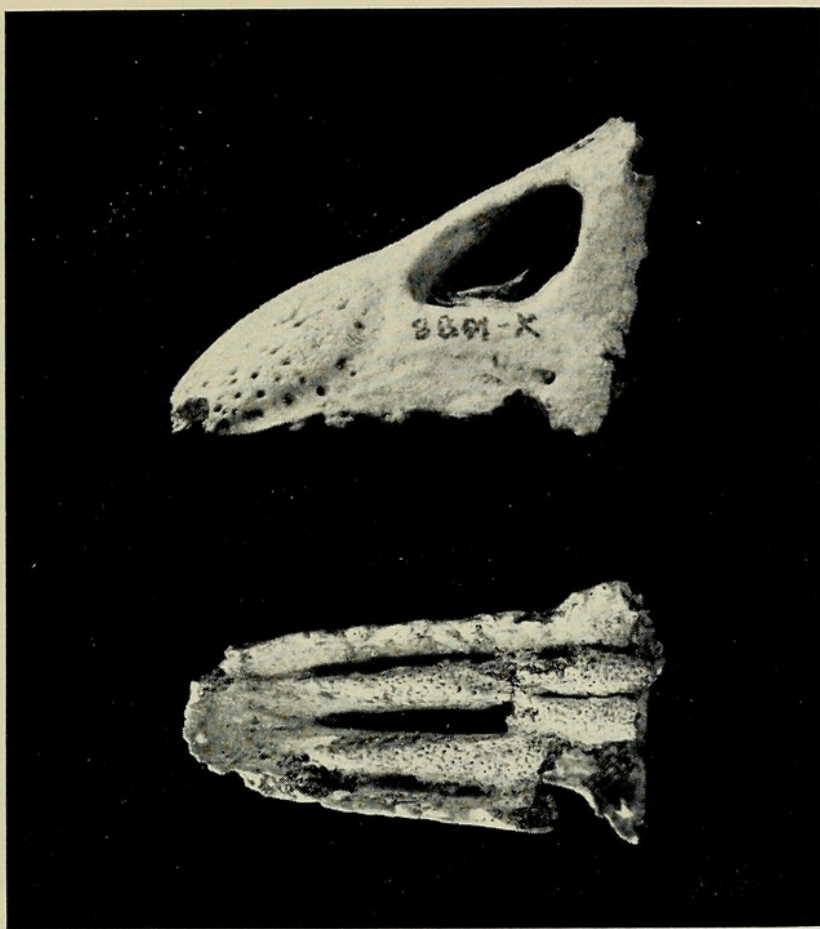


FIG. 4. *Thambetochen chauliodous*, new genus and species, holotype rostrum BBM-X 146029, left lateral view above and ventral view below. Natural size.

indicate that it was a female, with an egg in the oviduct at the time of entombment.

Measurements of holotype: Length of rostrum from naso-frontal hinge 55 mm, depth of rostrum at naso-frontal hinge 32, greatest length of nostril 19.1, width of rostrum at anterior of nostril 19.9, least width of internarial bar 6.0, depth of quadrate 23.2, width of cranium through temporal fossae 36.6, height and width of foramen magnum 11.9×9.1 , total length of mandible 98.6, length of mandibular symphysis 20.9, width of mandible at posterior margin of symphysis 19.8, length of coracoid 38.7, width of sternal end of coracoid 25.5, chord of scapula 74.2, anterior width of scapula 11.6, greatest length of sternum 90.0, width of sternum through penultimate costal facets 65.6, length of preacetabular ilium 68.6, length of postacetabular ilium 102.3, height of acetabulum 18.3, width of pelvis through antitrochanters 75.0, length of synsacrum 152.0, length of ulna 37.3, length of radius 35.3, length of carpometacarpus 17.9,

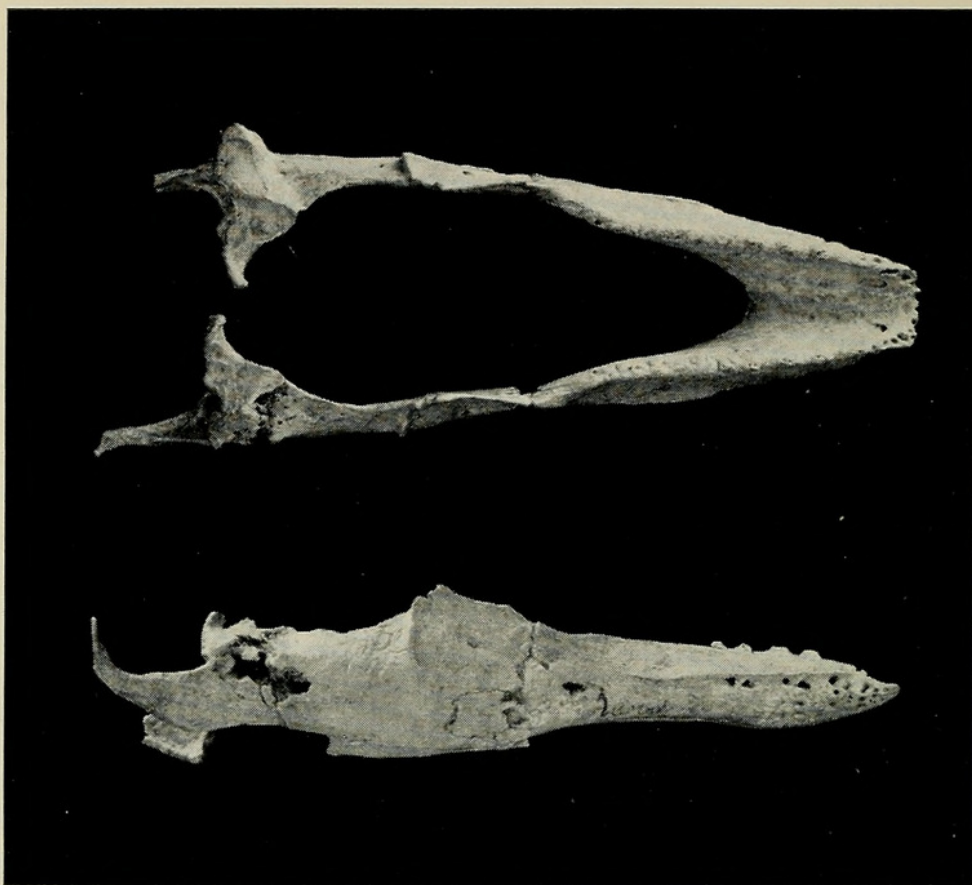
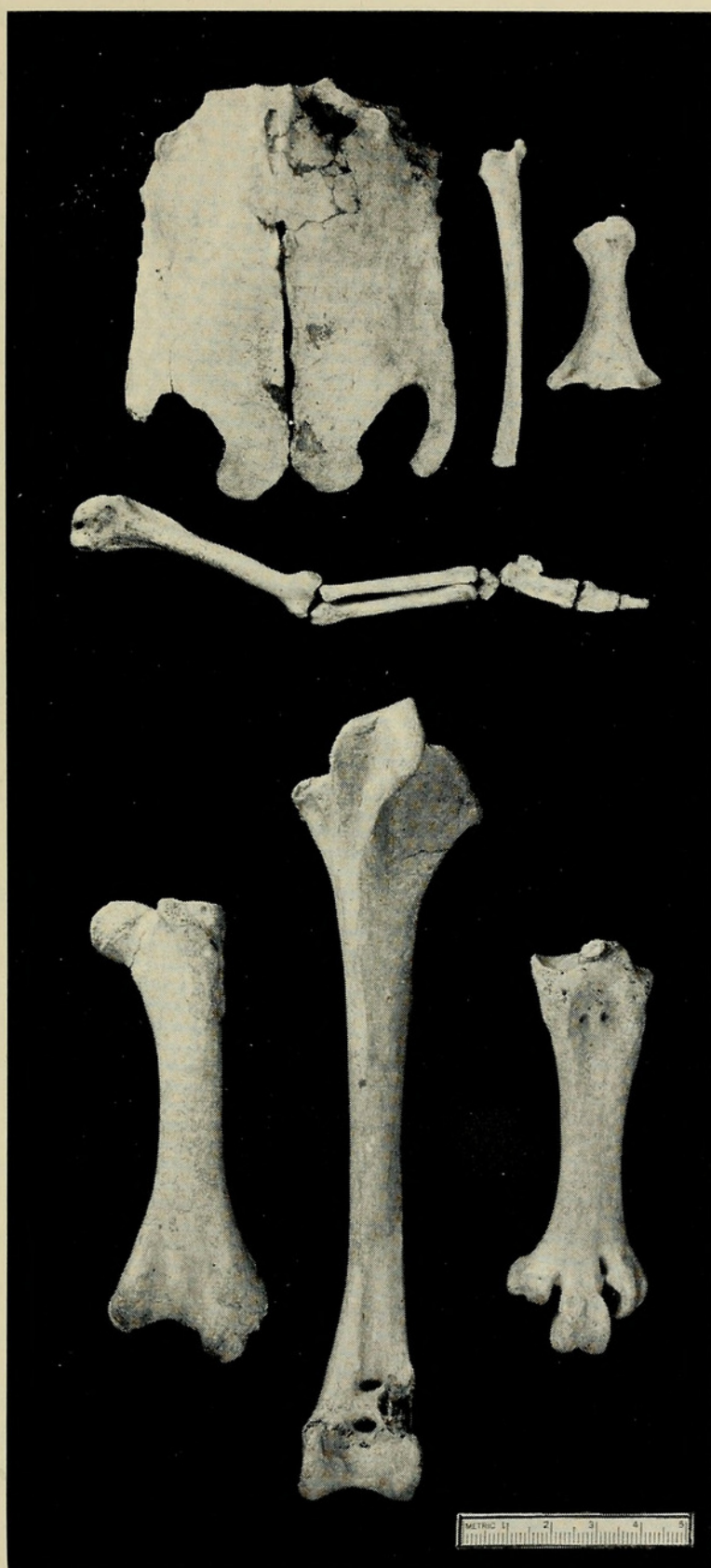


FIG. 5. *Thambetochen chauliodous*, new genus and species, holotype mandible BBM-X 146029, dorsal view above and right lateral view below. Reduced about 20%.

length of phalanx 1 digit II of wing 10.0, length of phalanx 2 digit II of wing 7.1, length of fibula 80.5, proximal width of fibula 16.9. Lengths of pedal phalanges: 1 of digit II 34.1, 1 of digit III 33.7, 2 of digit III 23.8, 1 of digit IV 26.9, 2 of digit IV 17.4, 3 of digit IV 13.6. For each long bone the following measurements represent length, proximal width, least width of shaft, and distal width, respectively: humerus 56.5, 13.9, 5.4, 10.6; femur 102.7, 36.3, 14.0, 36.3; tibiotarsus 172.0, 38.0, 12.0, 25.7; tarsometatarsus 92.4, 27.4, 13.3, 30.4.

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FIG. 6. *Thambetochen chauliodous*, new genus and species, holotype pectoral girdle and appendicular elements BBM-X 146029. Left to right and top to bottom: sternum (ventral view), left scapula (dorsal), left coracoid (ventral), right wing (dorsal), left femur, tibiotarsus and tarsometatarsus (anterior views). Scale = 5 cm.



Age: Pleistocene; land snail shells directly associated with holotype dated at about 25,000 years B.P. (Stearns, 1973).

Diagnosis: As for the genus.

Etymology: Gr. *chauliodous*, with prominent teeth.

Remarks: Wetmore (1943) described an extinct goose, *Geochen rhuax*, from Pleistocene ash (Pahala Formation) underlying 80 feet of lava on the island of Hawaii. This was based on poorly preserved fragments of tibiotarsus, femora, and pelvis. Wetmore believed *Geochen* to be related to the living Australian goose *Cereopsis novaehollandia* and the very large subfossil flightless goose of New Zealand, *Cnemiornis calcitrans*. *Thambetochen chauliodous* is much larger than *Geochen rhuax* and differs further from it as follows: tibiotarsus with less of a depression between the cnemial crests, tendinal bridge narrower and the opening distal to it rounded rather oval, groove for M. peroneus profundus much less distinct, external ligamental prominence absent, fibular crest much less developed and the nutrient foramen distal to it much smaller; trochanter of femur flattened and groove between trochanter and head virtually absent, whereas in *Geochen* the trochanter is raised and there is a distinct groove; ventral surface of head of femur not excavated. *Thambetochen* and *Geochen* may well be in some way related, but they are clearly different species and, as far as can be determined from the scanty available material of the latter, are generically distinct as well.

Thambetochen, although a large goose, is considerably smaller than *Cnemiornis*, from which it also differs in the much more reduced wings, utterly different bill structure, and in many other details. *Thambetochen* evidently evolved most of its manifest peculiarities after reaching the Hawaiian Islands, probably long before the arrival of the ancestors of the extant Nene Goose, *Branta sandvicensis*, to which it bears no relationship. *T. chauliodous* appears to have been rather common on Molokai, since there are remains of several individuals other than the holotype among the material collected so far.

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