A new species of large flightless rail of the *Rallus longirostris/elegans* complex (Aves: Rallidae) from the late Pleistocene of Bermuda

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Abstract.—*Rallus recessus*, new species, probably derived from the King Rail *R. elegans*, is described from a cave deposit exposed in quarrying operations on the island of Bermuda. This species had the reduced elements of the wing and pectoral girdle and more robust hindlimbs typical of flightless rails. It is the only member of the largest size-class of the genus *Rallus* known to have colonized an oceanic island and become flightless. It was present on Bermuda during the last (Wisconsinan) glacial period and appears to have become extinct naturally due to changing environmental conditions associated with changes in sea level.

Fluctuating sea-levels dramatically altered the land area of the North Atlantic island of Bermuda during the Pleistocene, causing natural turnover in major elements of the island's biota, particularly birds. At least two different avifaunas have been recognized from undated caves and fissures exposed in limestone quarrying operations. One of these is characterized by the presence of a crane, a duck, and two medium to small flightless rails—*Grus latipes*, *Anas pachysceles*, *Rallus ibycus*, and *Porzana piercei* (Wetmore 1960, Olson & Wingate 2000). These species are absent in the other fauna, which is dominated by a large, flightless derivative of the *Rallus longirostris/elegans* complex that has been alluded to previously as an unnamed species (Olson 1977, 1997; Olson & Wingate 2000).

These distinct avifaunas are thought to have existed during two different glacial periods of the Pleistocene when sea-levels were lower and the land area of Bermuda was greater than at present. Olson & Wingate (2000) made an assumption that the crane fauna was older than the fauna with the large rail. Although this assumption is now known to be correct, the crane fauna is probably not as old as they hypothesized.

The following description of the large rail is based entirely on the specimens collected in 1960 from "Rail Cave" in Government Quarry. Additional material of the species has since been found in two other deposits that are under investigation by P. J. Hearty (James Cook University, Queensland, Australia) and Olson. One of these promises to allow a very precise chronological reconstruction of the geology and paleontology of Bermuda in the late Quaternary, which will be presented elsewhere. For the present, we have been able to determine that the undescribed large rail existed during the last (Wisconsinan) glacial period. Therefore, we here proceed with naming it in order to be able to refer to it unambiguously in future publications.

Materials and Methods

Disassociated fossil elements are cataloged in the collections of the Florida Museum of Natural History and all specimens take the prefix UF PB, which we have omitted except in the citations of the holotype.
Table 1.—Measurements (mm) of selected skeletal elements of *Rallus recessus*, new species.

<table>
<thead>
<tr>
<th>Element</th>
<th>n</th>
<th>Range</th>
<th>Mean</th>
<th>S.D.</th>
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<tbody>
<tr>
<td><strong>Cranium</strong></td>
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<tr>
<td>Length from naso-frontal hinge</td>
<td>14</td>
<td>29.2–33.3</td>
<td>32.2</td>
<td>1.21</td>
</tr>
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<td>Width at postorbital processes</td>
<td>15</td>
<td>15.9–17.1</td>
<td>16.6</td>
<td>0.31</td>
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<tr>
<td>Width interorbital bridge</td>
<td>19</td>
<td>3.9–5.2</td>
<td>4.6</td>
<td>0.39</td>
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<tr>
<td><strong>Sternum</strong></td>
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<tr>
<td>Length along midline (from notch)</td>
<td>16</td>
<td>30.4–36.7</td>
<td>33.0</td>
<td>1.70</td>
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<td>Width across coracoidal sulci</td>
<td>17</td>
<td>12.0–14.6</td>
<td>13.1</td>
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<tr>
<td>Depth of carina</td>
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<td>6.0–9.2</td>
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<td><strong>Coracoid</strong></td>
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<tr>
<td>Length</td>
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<td>20.5–25.1</td>
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<td>1.30</td>
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<td><strong>Humerus</strong></td>
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<tr>
<td>Length</td>
<td>60</td>
<td>39.7–47.4</td>
<td>43.7</td>
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<tr>
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<td>59</td>
<td>8.4–10.5</td>
<td>9.4</td>
<td>0.45</td>
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<tr>
<td>Shaft width</td>
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<td>2.2–2.9</td>
<td>2.6</td>
<td>0.15</td>
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<tr>
<td>Distal width</td>
<td>60</td>
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<td>6.1</td>
<td>0.31</td>
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<tr>
<td><strong>Ulna</strong></td>
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<tr>
<td>Length</td>
<td>45</td>
<td>29.3–37.3</td>
<td>34.1</td>
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<tr>
<td>Length</td>
<td>18</td>
<td>28.1–34.3</td>
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<td><strong>Carpometacarpus</strong></td>
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<td>Length</td>
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<tr>
<td>Proximal depth</td>
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<td>5.5</td>
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<td><strong>Pelvis</strong></td>
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<td>32.8–42.9</td>
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<td>Width across antitrochanters</td>
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<td>20.1</td>
<td>1.25</td>
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<tr>
<td><strong>Femur</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Length</td>
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<td>44.3–52.4</td>
<td>49.1</td>
<td>2.12</td>
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<td>7.9–9.5</td>
<td>8.8</td>
<td>0.45</td>
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<tr>
<td>Distal width</td>
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<td>7.5–8.8</td>
<td>8.3</td>
<td>0.37</td>
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<tr>
<td><strong>Tibiotarsus</strong></td>
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<tr>
<td>Length from proximal articular surface</td>
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<td>58.0–71.9</td>
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<tr>
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<td>6.0–7.2</td>
<td>6.6</td>
<td>0.31</td>
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<tr>
<td><strong>Tarsometatarsus</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Length</td>
<td>29</td>
<td>36.6–44.6</td>
<td>40.9</td>
<td>2.21</td>
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<tr>
<td>Proximal width</td>
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<td>6.3–7.6</td>
<td>7.0</td>
<td>0.36</td>
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<tr>
<td>Distal width</td>
<td>29</td>
<td>6.7–8.1</td>
<td>7.4</td>
<td>0.40</td>
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</tbody>
</table>

and the figure legends. There is a great deal more material available than is listed among the type material. As paratypes we have listed those specimens that either were used in the descriptions, are illustrated, or were used for any of the cited measurements. Measurements of long bones of the limbs usually do not include broken or juvenile specimens, which accordingly are not among the listed paratypes. Measurements were taken with digital calipers to 0.01 mm and rounded to the nearest 0.1 mm.

*Comparative material examined.*—Skeletal material (complete unless otherwise indicated) of the following species in the collections of the National Museum of Natural History, Smithsonian Institution (USNM): *Rallus aquaticus* 431545, 553039, 553041; *R. lim-
Systematics

Family Rallidae
Genus *Rallus* Linnaeus

Referable to *Rallus*, sensu stricto, by the very long, slender bill and by the lack of characters suggesting relationship to the long-billed rails of the genus *Pardirallus* (including *Ortygonax*), which are not closely related to *Rallus* (Olson 1973).

*Rallus recessus*, new species

Figs. 1–5

_Holotype._—Cranium and rostrum consisting of the pila supranasalis and premaxillary symphysis but lacking the lateral nasal bar and ventral portions UF PB5108. Collected in February/March 1960 by Pierce Brodkorb and David B. Wingate.

_Type locality._—Bermuda, Hamilton Parish, Government Quarry, from a fissure called “Rail Cave” that was exposed in quarrying operations and that has since been quarried away.

_Choonology._—Late Pleistocene, last (Wisconsinan) glacial period.

_Measurements (mm) of holotype._—Total
Fig. 2. Comparison of skulls in dorsal view (a, d) and sternum in ventral view (b–c, e) of Rallus. a, R. recessus, new species, holotype UF PB5108; d, e, R. elegans female USNM 499437; b, c, R. recessus, new species, UF PB5124, UFPB 5126. Scale bar = 2 cm.

length, 93.6; rostrum from nasofrontal hinge to tip, 62.7; length of premaxillary symphysis, 21.1; length of cranium from naso-frontal hinge, 33.1; width of cranium at postorbital processes, 17.0; width of interorbital bridge 4.8.


Measurements (mm) of paratypes.—Rostrum: length from naso-frontal hinge, 61.5, 62.5, 62.7, 63.8; length of premaxillary
symphysis, 21.1, 21.1, 21.6, 22.0. Scapula: length 42.4. For other measurements see Table 1.

Associated paratype.—An articulated incomplete skeleton covered with flowstone was collected on a block of limestone from Rail Cave and is now on exhibit in the Bermuda Aquarium, Museum and Zoo (BAMZ 2000 190 001). Not all of the skeleton is present and the measurements of the remaining elements will in most cases probably be slightly too large because of their casing of flowstone. In size, the specimen would be at the small end of size variation in the species, presumably a female. The following length measurements (mm) were obtained. Total length of skull and bill 77.7; rostrum from nasofrontal hinge 49.6; cranium from nasofrontal hinge 19.6; mandible 66.2; coracoid 20.5; humerus 39.9; femur 44; tibiotarsus 60; tarsometatarsus 37.5.

Etymology.—Latin, recessus, used here with a double meaning; first, to refer to reccession of the sea during the glacial period that this species occupied Bermuda (recessus marini aestus being low tide in Latin), and also to the second meaning of the word, a nook, corner, or secret spot, in reference to the hidden chamber in which the type material was secreted.

Diagnosis.—Larger than any of the species of Rallus (sensu stricto, Olson 1973) except those of the R. longirostris/elegans
complex. Differs from related species in characters associated with flightlessness and in having a proportionately longer and more slender bill, with a longer and more decurved premaxillary symphysis. The width of the interorbital bridge is intermediate between that of \( R. \) longirostris and \( R. \) elegans. Flight apparatus greatly reduced in development. Hindlimb elements shorter and much more robust.

*Description.*—In addition to the longer, more decurved bill, this species has the orbits reduced so the frontal area in lateral view slopes more steeply. There are no impressions for salt glands on the interorbital bridge, unlike \( R. \) longirostris. The cranium is narrow, which is less like \( R. \) elegans.

Compared with \( Rallus \) longirostris/elegans, the sternum is shorter and wider with the carina greatly reduced, although a small manubrial spine is present and there is no deep notch between the coracoidal sulci as in many flightless rails. The sternocoracoidal process of the coracoid is more pointed and projecting. The humerus has the head smaller, the capital groove wider, the shaft more curved and the brachial depression deeper. The ulna is very short and more curved and the carpometacarpus small.

The pelvis is wider with the postacetabular portion proportionately shorter, the ischial area in lateral view is much less deep, the ilia do not extend as far posteriorly beyond the sacrum, and the ilioischadic fenestra is smaller. The hindlimb elements are shorter, both absolutely and relatively, and more robust, particularly the shafts.

*Remarks.*—The large species of \( Rallus \) included in the \( R. \) longirostris/elegans complex are confined to the New World. Their interrelationships, biogeography, and hypothetical history have been discussed by Olson (1997), who argued on the basis of the interorbital bridge that the Bermuda bird

Fig. 4. Comparison of pelves of \( Rallus \) in dorsal view. \( a, R. \) recessus, new species, UF PB5287; \( b, R. \) elegans (USNM 610781 female). Scale bar = 2 cm.
was a derivative of *Rallus elegans* that had become adapted to somewhat higher salt stress, rather than a derivative of *R. longirostris*. According to Olson’s hypothesis, *R. elegans* was the original North America stock of large *Rallus* that was later displaced from Gulf and Atlantic salt marsh habitats by an invasion of *R. longirostris*. Although the salt-marsh Clapper Rail, *R. longirostris*, has been found as a very rare vagrant to Bermuda, the King Rail, *R. elegans*, has not yet been recorded there (Amos 1991).

**Acknowledgments**

As in our previous paper (Olson & Wingate 2000) we are indebted to officials at the Bermuda Government Quarry, the late Pierce Brodkorb, Marc Frank, and David W. Steadman for assistance in obtaining and studying the specimens, Paul J. Hearty for geological insights, Helen James for statistics, and John Steiner, Victor E. Krantz, and Brian Schmidt for photography and arrangement of figures. We thank Lisa Green and Wolfgang Sterrer of the Bermuda Aquarium, Natural History Museum and Zoo (BAMZ) for access to the associated paratype and many other considerations. This is contribution #37, Bermuda Biodiversity Project (BBP), of the BAMZ.

**Literature Cited**


——. 1997. Towards a less imperfect understanding
