

## A Miocene Passeriform Bird from the Iwami Formation, Tottori Group, Tottori, Japan

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**Abstract** A new fossil bird from the Miocene Iwami Formation is described herein. The single specimen is composed of more than 13 postcranial elements and feather traces. The morphology of the carpometacarpus and foot suggests that this specimen can be identified as a passeriform bird of approximately 200 mm in total length. This fossil is the oldest record for the Passeriformes in Japan and the oldest record of the group in Asia.

**Key words:** Miocene, Passeriformes, bird, Tottori, Iwami, Fuganji

### Introduction

The Iwami Formation is known for beautifully preserved fishes such as *Spirinchus akagi* (Uyeno and Sakamoto, 1999) and *Inabaperca taniurai* (Yabumoto and Uyeno, 2000). In the summer of 2003, Tottori Prefectural Museum conducted intensive prospecting for vertebrate fossils in the Iwami Formation, Tottori Group, for five days. During this fieldwork led by Teruya Uyeno, Yoshitaka Yabumoto and Takeyu Aoki, a bird fossil was found and it was subsequently catalogued at the Tottori Prefectural Museum (TRPM 667-011) and casts were deposited at the National Science Museum (NSM-PV 20721). The specimen is described herein. Previous reports of fossil birds from the formation (Akagi *et al.*, 1992; Hirao, 2000), briefly mention some skeletal elements and feather traces without any figures. Some specimens were deposited at the Fukui Prefectural Dinosaur Museum and the Osaka City Museum of Natural History. There are casts of some of these specimens at the National Science Museum (NSM-PV 18693–18695).

### Geological Setting

The fossil locality is located in Miyanoshita, Kokufu-cho, Iwami-gun, Tottori Prefecture (Fig. 1). The outcrop consists of mudstone within the Fuganji Member, Iwami Formation, Tottori Group (Fig. 2). The fossil horizon is most likely to be dated as the late Early Miocene to the early Middle Miocene based upon benthic foraminifera, molluscan occurrence such as the *Propeamussium-Delectopecten* assemblage, the *Acesta* assemblage from overlying horizons (Matsumoto, 1992). The paleoenvironment is considered to be a shallow marine deposit, based upon the fishes such as Clupeiformes and Salmoniformes, molluscan and land plant fossils (Akagi *et al.*, 1992).

### Systematic Paleontology

Aves Linnaeus, 1758

Passeriformes Linnaeus, 1766

Family indet.,

gen. et sp. indet.

(Fig. 3)

*Materials:* TRPM 667-011 (casts: NSM-PV

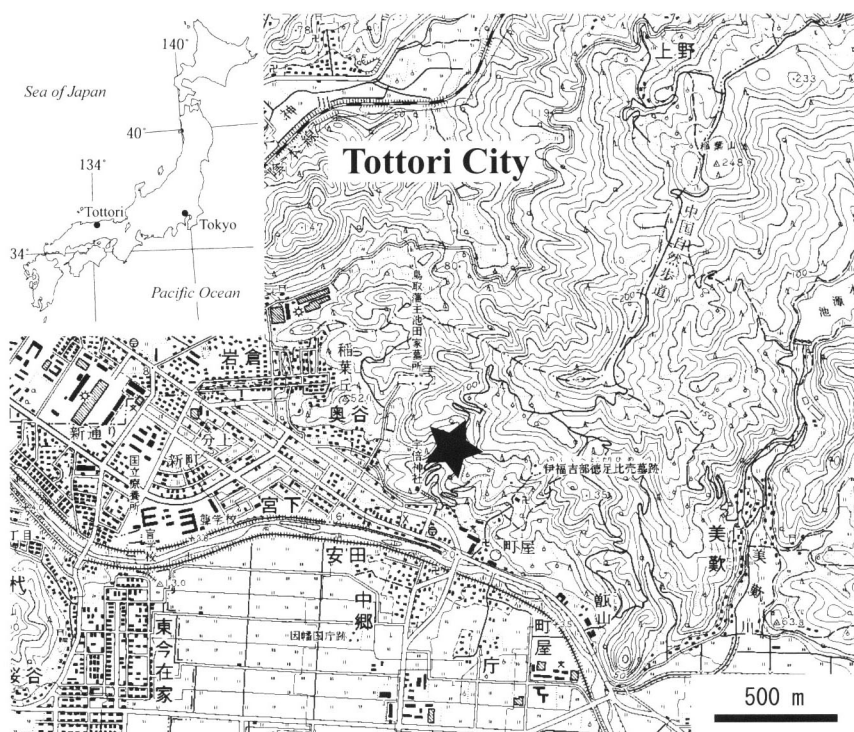


Fig. 1. Map showing the locality (Star mark) of TRPM 667-011, a passeriform bird, in Miyanoshta, Kokufu-cho, Iwami-gun, Tottori Prefecture based on 1: 25,000 map of 'Inaba-yama' published by the Geographical Survey Institution. (Modified from Hirao, 2000, Fig. 1).

20721) is an impression (the original bone is absent due to weathering of the rock) of a partial skeleton comprising mainly of the left wing (with feather traces) and mostly articulated legs and feet. There are counterparts for each skeletal element.

**Description:** The left wing includes the carpometacarpus, manual digits I, II (phalanx 1) and the ulnare. The carpometacarpus is straight and 17 mm in length, the length of the intermetacarpal space is 7 mm long, the width of the metacarpal II is approximately two times that of the intermetacarpal space, the metacarpal III is very narrow (less 0.5 mm), a facet for digit III is more distal than the facet for digit II, the intermetacarpal tuberosity overlaps or fuses with metacarpal III. Phalanx 1 of manual digit II is rectangular (7.5 mm long and 2 mm wide) and slightly curved laterally. The left leg comprises of the distal end of the femur and tarsometatar-

sus, nearly complete tibiotarsus with a fibula and incomplete digit II to IV. The right leg is nearly complete, comprising of the complete femur and tarsometatarsus with accessory metatarsus, tibiotarsus (broken into two parts), a fragmentary fibula, complete digits I to III and an incomplete digit IV. The right femur is slightly curved and it is 20.5 mm in length. The tibiotarsus (left 34+ mm long and estimated to be approximately 38 mm in length) is mostly straight and the proximal end expands anteroproximally. The tarsometatarsus (26 mm long) is straight, the proximal end in medial view projects anteriorly and the hypotarsal ridge seems to be developed. The foot topology is anisodactyl (which is typical of songbirds and most other perching birds). In the right foot, the third digit is 18.5 mm long, phalanx 1 of digit I is 10.5 mm long, and phalanx 2 of digit I is 8.5 mm long. According to Gilbert *et al.* (1985), two characters, a facet for digit III more distal than

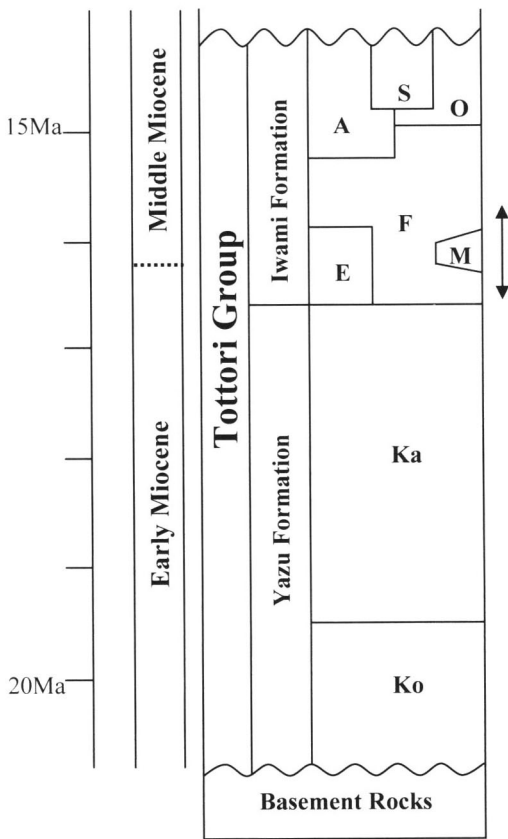


Fig. 2. Stratigraphic position of TRPM 667-011. (After Takayasu *et al.*, 1992; Matsumoto, 1992). The arrow shows the possible stratigraphic range of the locality within the Iwami Formation. Abbreviations: A, Aragane Pyroclastic Member; E, Entsuji Conglomerate and Sandstone Member; F, Fuganji Mudstone Member; Ka, Kawabara Volcanic Member; Ko, Koge Conglomerate Member; M, Moroga Conglomerate Member; O, Oda Andesite Member; S, Shichiyama Sandstone and Mudstone Member.

the facet for digit II, and the intermetacarpal tuberosity overlapping or fusing with metacarpal III, are only present in Passeriformes, Galliformes (some exceptions such as cracids which do not have the intermetacarpal tuberosity) and Picidae. In our observation, the facet for digit III of TRPM 667-011 is significantly pronounced in comparison to those seen in Galliformes. A well developed intermetacarpal tuberosity is already present in an Early Eocene passeriform bird from

Australia (Boles, 1995, 1997). The foot topology of the Picidae is zygodactyl (the second and third toes anterior; the first and fourth toes posterior) (e.g. Feduccia, 1996). Therefore, TRPM 667-011 can be classified as a passeriform bird.

*Comparison:* As the specimen is mainly an impression of the skeletal elements, it is difficult to assign it beyond the ordinal level. It has therefore been classified as an indeterminate passeriform. The bird is estimated to be approximately 200 mm in total length based on the maximum length of left carpometacarpus, right femur and tarsometatarsus and nearly complete tibiotarsi. The proportion of the leg bones of TRPM 667-011 differ significantly from those of a previously found bird from the same formation, NSM-PV 18693-a (part) and b (counterpart), suggesting the specimens represent a different species.

## Discussion

The Passeriformes are a diverse group that occupies approximately 60% of extant species (e.g. Boles, 1995). Although molecular data suggests that the group might have evolved by the middle Cretaceous (e.g. Hedges *et al.*, 1996), the oldest fossil record of passeriform birds come from the Early Eocene, Tingamarra Local Fauna at Murgon, south-eastern Queensland, Australia (Boles, 1995, 1997). By the end of the Miocene, seven families (Eurylaimidae, Alaudidae, extinct Palaeoscinidae, Sittidae, Orthonychidae, Emberizidae and Corvidae) have been documented from Australia, Europe and North America (Boles, 1993; Unwin, 1993). In Asia, the oldest fossil record of the Passeriformes is a motacillid from the Early Pliocene of eastern Kazakhstan (Unwin, 1993). In Japan, the earliest record of the Passeriformes is probably a juvenile bird from the Pliocene Kabutoiwa Formation that outcrops across Nagano and Gunma Prefectures (Koshimizu, 1984).

TRPM 667-011 is the oldest passeriform from Japan, and also the oldest record in Asia. The addition of this new specimen (TRPM 667-011) provides at least another species of birds for the

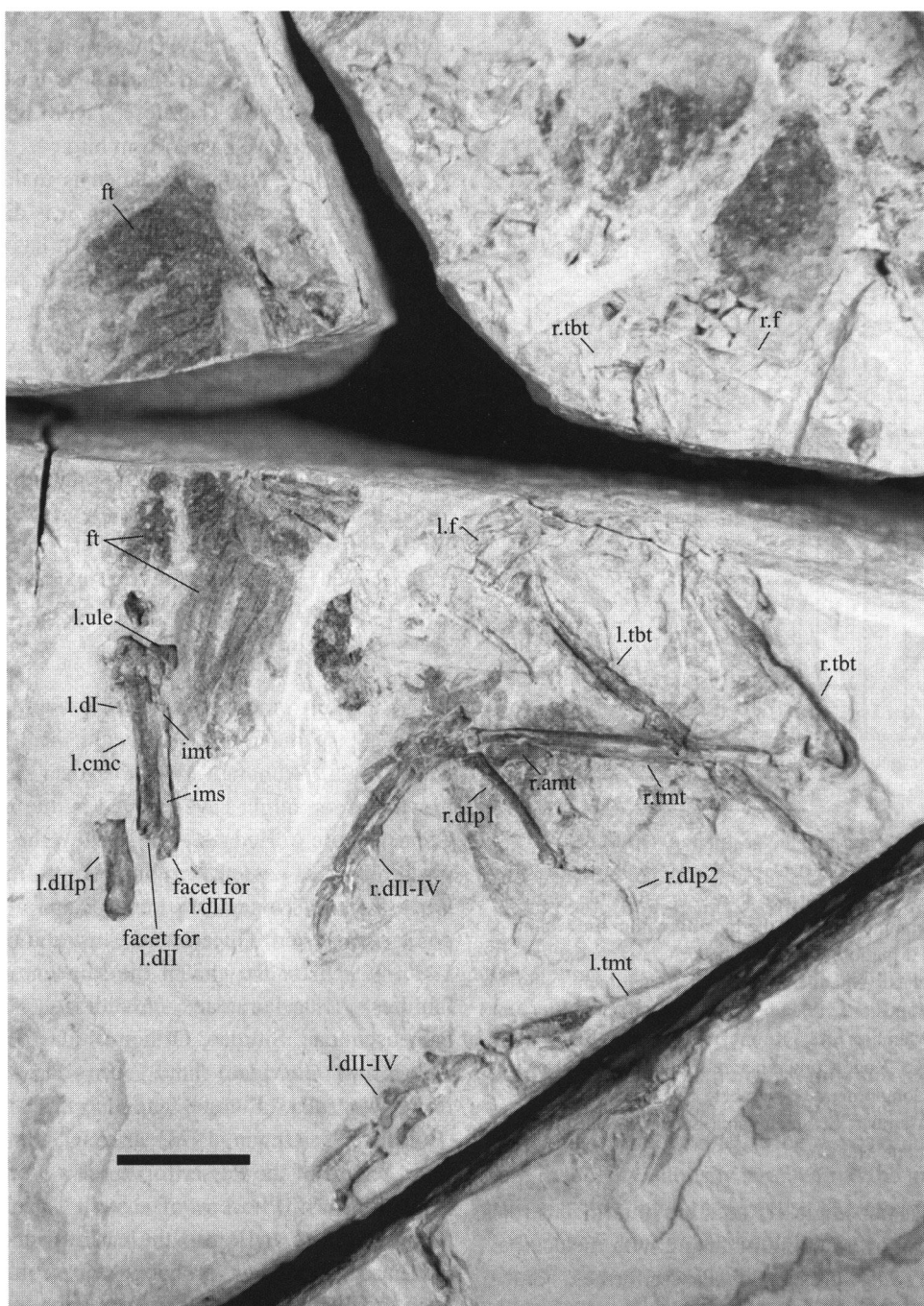


Fig. 3. Passeriformes fam., gen. et sp. indet. (TRPM 667-011). Abbreviations: amt, accessory metatarsus; cmc, carpometacarpus; d, digit; f, femur; ft, feather traces; ims, intermetacarpal space; imt, intermetacarpal tuberosity; L, left; p, phalanx; r., right; tbt, tibiotarsus; tmt, tarsometatarsus; ule, ulna; I–IV, the first-fourth. Scale 10 mm.

Iwami Formation. Thus, the wealth of avian diversity in the Japanese Miocene is beginning to emerge, due to the efforts of the Tottori Prefectural Museum field prospecting.

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