Bull. Kitakyushu Mus. Nat. Hist., 19: 105–110. March 31, 2000

The First Record of the Early Cretaceous Freshwater Fish, *Wakinoichthys aokii*, from Korea

Yoshitaka YABUMOTO[1] and Seong-Young YANG[2]

[1]Kitakyushu Museum and Institute of Natural History,
Nishihonmachi, Kitakyushu, Fukuoka 805, Japan
[2]Department of Earth Science, Teachers College,
Kyungpook National University, Taegu, Korea
(Received November 25, 1999)

Abstract *Wakinoichthys aokii* was found from the Nagdong Subgroup of the Gyeongsang Group in a southern part of Korea. The species was first described from the Wakino Subgroup of the Kanmon Group from Kitakyushu, Japan in 1994. This is the first record from Korea other than the type locality. The existence of the species in both Japan and Korea suggests that the Nagdong Subgroup of the Gyeongsang Group and the Wakino Subgroup of the Kanmon Group are deposited at almost the same age.

Introduction

Fossils from the Gyeongsang Group have been studied since YABE (1905) described fossil plants and named the Nagdong flora. There have been many studies on molluscan fossils from the Gyeongsang Group (KOBAYASHI and SUZUKI, 1936; SUZUKI, 1940, 1943; YANG, 1975, 1978, 1979).

A cooperative research of Korea and Japan has been carried out since 1977 to uncover fish fossils at several localities of the Gyeongsang Group in the southern part of Korea. One specimen of *Wakinoichthys aokii* was discovered from Chinju City in Kyongsangnam-do, Korea. This species was originally described from the Wakino Subgroup in Kitakyushu, Japan (YABUMOTO, 1994). We hereby describe the specimen of *W. aokii* from Korea. Since this species existed in Korea and Japan, we suggest some geological relationship between two locations in the Early Cretaceous.

Locality and horizon

The specimen was found in Chinju City in Kyongsangnam-do, the southern part of Korea (Fig. 1). The horizon is the upper part of the Dongmyeong Formation of the Nagdong Subgroup in the Gyeongsang Group. The age is Neocomian, Early Cretaceous.

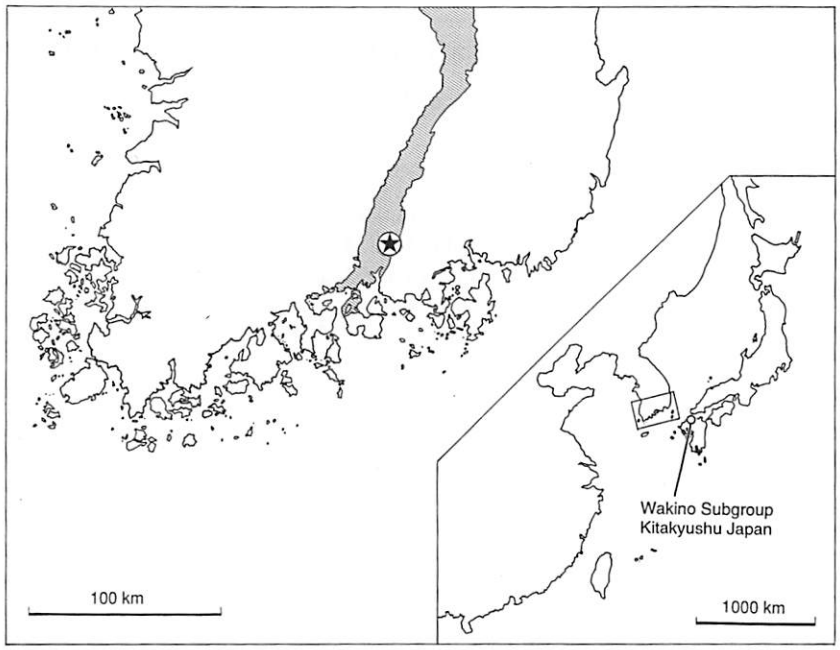

Fig. 1. Locality of *Wakinoichthys aokii* in Korea. The shaded part indicates the Nagdong Subgroup of the Gyeongsang Group.

Family Wakinoichthiidae
Genus *Wakinoichthys* YABUMOTO, 1994
Wakinoichthys aokii YABUMOTO, 1994

KMNH (Kitakyushu Museum and Institute of Natural History) VP 100,242. The specimen is almost complete, with its right side exposed, but the lower jaws are disarticulated and bent downward. The estimated standard length is 62.4 mm.

The body is slender and the estimated standard length is 6.4 times longer than the body depth. The median fins are relatively posterior in position. The dorsal origin is behind the anal origin. The first dorsal pterygiophore is inserted between the fifth and sixth caudal vertebrae. The dorsal fin base is short and it is about half of the anal fin base. The pectoral fin is elongated. The upper most pectoral fin ray is stout. The pelvic fin is situated at the middle of the abdomen. The caudal fin is forked (Fig. 2).

Ten principal dorsal fin rays can be counted and have 11 dorsal fin pterygiophores. The number of principal anal fin rays is 21. There are 20 anal pterygiophores. The number of pectoral fin rays is 11. The number of pelvic fin rays is 7. The total number of vertebrae is 47, with 22 caudal vertebrae. The anterior end of the vertebral column is not visible. The number of abdominal

Fig. 2. KMNH VP 100,242, *Wakinoichthys aokii* from the Dongmyeong Formation of the Gyeongsang Group in Korea.

vertebrae is estimated on the basis of a number of ribs. The number of ribs is 23. There is a series of median supraneurals. The anterior supraneurals are wide and leaf-shape with a ridge running from a dorso-posterior corner to an antero-ventral corner.

The lower jaw is long. The dentary bears small canine-like teeth on its oral margin. The mandibular sensory canal runs within the dentary. The premaxilla has canine-like teeth that are larger than those of the dentary. The maxilla is not visible. There are villiform teeth on the endopterygoid. The teeth are not visible on the parasphenoid. The frontal is long (Fig. 3).

The first preural centrum bears the narrow parhypural. There are seven hypurals. The first hypural is largest. The second hypural is preserved as only the anterior part. There is a space between the third and the fourth hypurals. The third to seventh hypurals are slender and cylindrical. The third one is most slender. The second ural centrum bears two hypurals (h3–4). Three uroneurals are visible. Epural is not visible. There are 18 principal caudal fin rays (1,8,8,1) (Fig. 4).

Concluding remarks

The present fish fossil is identified as *Wakinoichthys aokii* by having the following characters: the slender body, the long pectoral fin, the long lower jaw with small canine-like teeth on the dentary, eighteen principal caudal fin rays (1,8,8,1), seven hypurals, forty-seven vertebrae, the broad median supraneurals, the dorsal origin behind the anal origin and the short dorsal fin base. This species was described from the Early Cretaceous Wakino Subgroup in Kitakyushu, Japan (YABUMOTO, 1994). This is the first record of this species from Korea other than the type locality.

The geological relationship between the Nagdong Subgroup and the Wakino

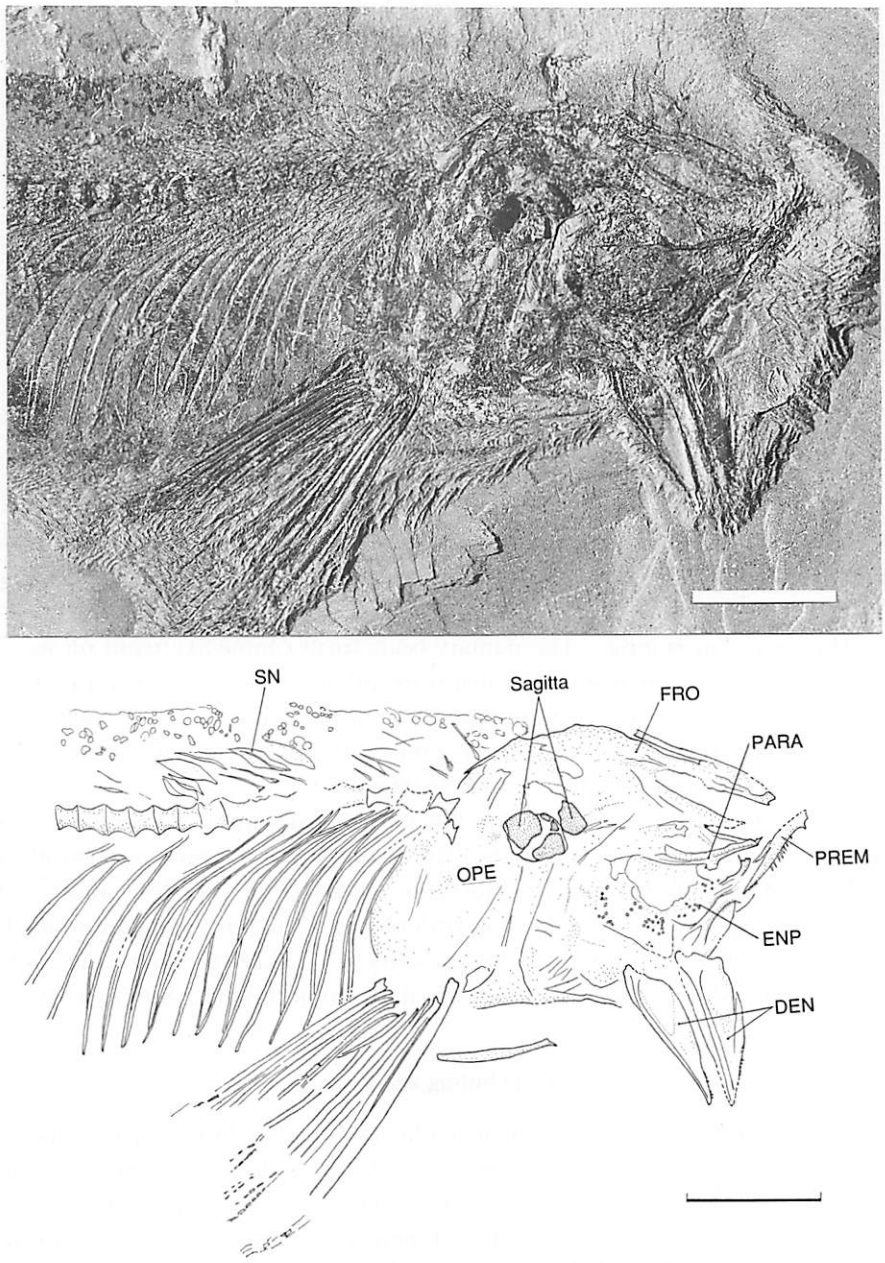

Fig. 3. Head part of the specimen KMNH VP 100,242, *Wakinoichthys aokii* from the Dongmyeong Formation of the Gyeongsang Group in Korea. DEN, dentary; ENP, endopterygoid; FRO, frontal; OPE, opercle; PARA, parasphenoid; PREM, premaxilla; SN, supraneural. Scales = 5 mm.

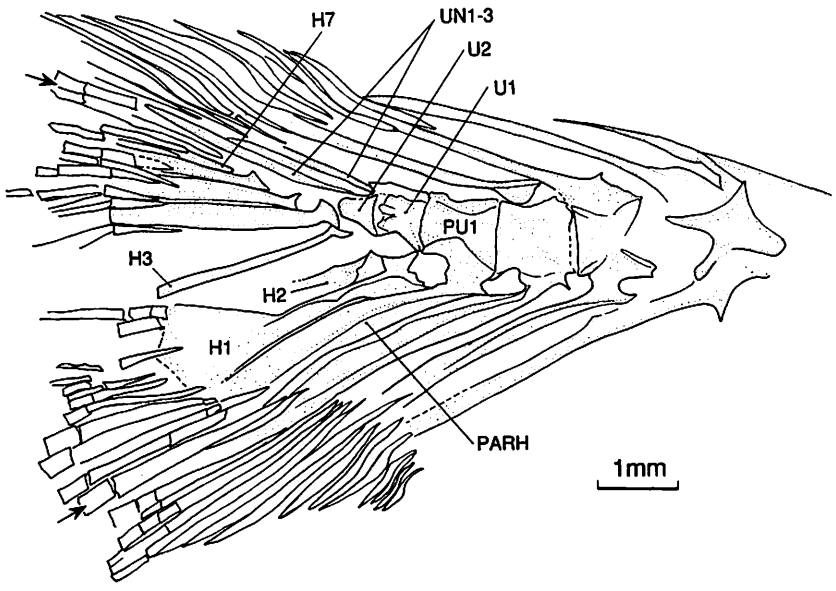

Fig. 4. Caudal part of the specimen KMNH VP 100,242, *Wakinoichthys aokii* from the Dongmyeong Formation of the Gyeongsang Group in Korea. H, hypural; PARH, parhypural; PU, preural centum; U, ural centrum; UN, uroneural.

Subgroup has been discussed by paleontologists and geologists. KOBAYASHI and SUZUKI (1936) described 8 species of freshwater mollusca including three common species between the Nagdong and Wakino subgroups and considered that the Wakino Subgroup could be related to the Nagdong Subgroup because of sharing the common species. OTA (1953) pointed out the lithologic similarity between the Nagdong and Wakino subgroups and difference of their thickness. In the bivalve fossils from the Gyeongsang Group, YANG (1979) recognized five common species with the Japanese Cretaceous non-marine beds, which are the Wakino Subgroup, the Akaiwa Subgroup of the Tetori Group, and the Sebayashi Formation. He thought that the *Nagdongia soni* Zone, which contains the Yeonhwadong Formation, Hasandong Formation and the lower part of the Dongmyeong Formation, is related to the Wakino Subgroup. Our discovery of *W. aokii* from both the Dongmyeong Formation in Korea and the Gamo and Kumagai formations in Kitakyushu, Japan, supports further the similarity between the Wakino and Nagdong subgroups, since the Gamo and Kumagai formations are equivalent to the Lower and Upper Wakamiya formations (YABUMOTO, 1994; NAKAE *et al.*, 1998). OTA (1953) suggested a close relationship between the Dongmyeong Formation and the Lower Wakamiya Formation. We suggest that both the Nagdong and Wakino subgroups are at least the same age, but we need further study on other fossil fishes to resolve the relationship between both sediments.

Acknowledgments

We wish to express my sincere gratitude to Dr. Teruya UYENO of the National Science Museum, Tokyo and Dr. Tsutomu MIYAKE of Dalhousie University for their valuable advice and critical reading of this manuscript. We thank Mr. Tateyu AOKI of Toko Junior High School in Fukuoka City, a member of the Kitakyushu Natural History Society, for his help in the fieldwork and preparation of the specimen. We also wish to thank to Mrs. KIM Kibon, KIM Taewan and PARK Tookwang of Korean Fossil Association for their help in the fieldwork. This joint research was made possible by grants from the Japan-Korea Basic Scientific Corporation Program of Japanese Society for the Promotion of Science and from Fujiwara Natural History Foundation.

Literature Cited

KOBAYASHI, T. and K. SUZUKI. 1936. Non-Marine shells of the Naktong-Wakino Series. *Japan. J. Geol. Geogr.*, **13**(3–4): 243–257, pls. 27–29.

NAKAE, S., M. OZAKI, M. OTA, Y. YABUMOTO, H. MATSUURA, S. TOMITA. 1998. Geology of the Kokura district. With Geological Sheet Map at 1 : 50,000. *Geol. Surv. Japan*, viii + 126 pp.

OTA, Y. 1953. On the Mesozoic system in Mt. Kasagi District (So-called Wakino district), Kurate-gun, Fukuoka Prefecture. *Bull. Fukuoka Gakugei Univ.*, (2): 206–213.

SUZUKI, K. 1940. Non-marine molluscan fauna of the Siragi series in south Tyosen. *Japan. Jour. Geol. Geogr.*, **17**(3–4): 215–231, pls. 22–24.

SUZUKI, K. 1943. Restudy on the non-marine molluscan fauna of the Rakuto series in Keisyo-do, Tyosen. *Jour. Sigenkagaku Kenkyusho*, **1**(2): 189–219, pls. 14–19.

SUZUKI, K. 1949. Development of the fossil non-marine molluscan faunas in eastern Asia. *Japan. Jour. Geol. Geogr.*, **21**(1–4): 91–133.

YABE, H. 1905. Mesozoic plants from Korea. *Jour. Coll. Sci., Imp. Univ. Tokyo*, **20**(8): 1–59, pls. 1–4.

YABUMOTO, Y. 1994. Early Cretaceous Freshwater fish fauna in Kyushu, Japan. *Bull. Kitakyushu Mus. of Nat. Hist.*, (13): 107–254, pls. 36–59.

YANG, S. Y. 1975. On a new non-marine pelecypod genus from the upper Mesozoic Gyeongsang Group of Korea. *Trans. Proc. Palaeont. Soc. Japan, N. S.*, (100): 177–187, pls. 16–17.

YANG, S. Y. 1978. On the discovery of *Nippononaia ryosekiana* from Gyeongsang Group, Korea. *Jour. Geol. Soc. Korea*, **14**(2): 33–43, pl. 1.

YANG, S. Y. 1979. Some new bivalve species from the Lower Gyeongsang Group, Korea. *Trans. Proc. Palaeont. Soc. Japan, N. S.*, (116): 223–234, pls. 27–28.

Yang, S. Y. 1979. On international correlation with non-marine-brackish water fossils — Especially on the bivalve fauna from the Gyeongsang Group, Korea. *Fossils*, (29): 65–96.

Akaiwa Subgroup 赤岩亜層群, Chinju 晋州, Dongmyeong Formation 東明層, Gamo Formation 蒲生層, Gyeongsang Group 慶尚層群, Hasandong Formation 霞山洞層, Kanmon Group 関門層群, Kim Kibon 金基本, Kim Taewan 金泰完, Kumagai Formation 熊谷層, Kyongsangnam-do 慶尚南道, Lower Wakamiya Formation 若宮下部層, Nagdong Subgroup 洛東層, Park Tookwang 朴斗洸, Sebayashi Formation 瀬林層, Tetori Group 手取層群, Wakino Subgroup 脇野亜層群, Yeonhwadong Formation 蓮花洞層