Early Cretaceous plant fossil assemblages from the Tetori Group in the Itoshirogawa area, Hakusan Region, central Japan

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The Tetori Group is a Middle Jurassic - Lower Cretaceous sequence distributed in the Inner Zone of Southwest Japan. The Tetori Group consists of three subgroups: the Kuzuryu, Itoshiro and Akaiwa subgroups in ascending order (Maeda, 1961). The Kuzuryu Subgroup consists mainly of marine sediments, and the Itoshiro and Akaiwa subgroups consist mainly of non-marine sediments.

Kimura (1987) recognized two distinct floras in Late Jurassic and Early Cretaceous sediments in Japan, the Tetori-type and Ryoseki-type floras together with the Mixed-type Flora. Plant fossil assemblages from the Tetori Group include various ferns and ginkgoaleans classified as Tetori-type floral elements, which flourished under a humid warm-temperate climate (Kimura, 1987). The Ryoseki-type floral elements were recently discovered from the Lower Cretaceous Tetori Group (Yabe et al., 2003). The Ryoseki-type Flora is considered to be indicative of a subtropical condition with dry season (Kimura, 1987). We report the occurrence of the Ryoseki-type floral elements from the Akaiwa Subgroup of the Tetori Group in the Itoshirogawa area, Hakusan Region, central Japan.

In the northern part of the Itoshirogawa area, the Itsuki Formation of the Itoshiro Subgroup and the Nochino Formation of the Akaiwa Subgroup are exposed. The Itsuki Formation is composed mainly of alternating beds of mudstone and sandstone. The formation has yielded plants and brackish-water and freshwater mollusk fossils. The formation is tentatively regarded as Barremian in age based on zircon U–Pb dating which the youngest zircon grain from the sandstone of the formation has a concordant age of 127.2 ± 2.5 Ma (Kawagoe et al., 2012). The Nochino Formation is composed mainly of coarse-grained sandstone, orthoquartzite-bearing conglomerate and alternating beds of mudstone and sandstone. Plant fossils occur commonly in the alternating beds.

Plant assemblages from the Itsuki Formation of the Itoshiro Subgroup include 25 species of 20 genera (*Thallites yabei*, *Equisetites ushimarensis*, *Adiantopteris sewardi*, *Cladophlebis* ex gr. *denticulate*, *Coniopteris burejensis*, *Eboracia* sp., *Onychiopsis*

elongate, *Osmundopsis distans*, *Sphenopteris* sp., *Sagenopteris* sp., *Nilssonia kotoi*, *N. nipponensis*, *Dictyozamites kawasakii*, *Neozamites elongates*, *Otozamites* sp., *Ginkgoidium nathorsti*, *Ginkgoites digitata*, *Czekanowskia* sp., *Pityophyllum* sp., *Podozamites reinii*, *P. lanceolatus*, *Taeniopteris emarginata*, *T. vittata* etc...). Plant assemblages from the Nochino Formation of the Akaiwa Subgroup include 23 species of 18 genera (*Equisetites ushimarensis*, *Adiantopteris* sp., *Cladophlebis* ex gr. *denticulate*, *C. hukuiensis*, *Gleichenites nipponensis*, *G. porsildi*, *G. yamazakii*, *Onychiopsis elongate*, *Sphenopteris* sp., *Sagenopteris* sp., *Pterophyllum* sp., *Zamiophyllum* (?) sp., *Ginkgoidium nathorsti*, *Ginkgoites digitata*, *Czekanowskia* sp., *Brachyphyllum* (?) sp., *Elatocladus* spp., *Pagiophyllum* sp., *Podozamites reinii*, *P. lanceolatus*, *Taeniopteris emarginata* etc...). The assemblage from the Nochino Formation is the Mixed-type Flora because the occurrence of the Ryoseki-type floral elements (*Zamiophyllum* and *Brachyphyllum*) and the Tetori-type species are mixed.

The recognition of the Mixed-type Flora is important to understand climatic change in East Asia during Early Cretaceous. The floristic compositional change from the Tetori-type to the Mixed-type occurs around the lithostratigraphic boundary between the Itoshiro and Akaiwa subgroups. The mixed-type flora in the Tetori Group appeared probably in Berremian time. The change could be resulted from a warming and drying climatic trend under which the lower Cretaceous Tetori Group was deposited.

References

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