31. A New Carboniferous Trilobite from the Hida Plateau, West Japan

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Silurian and later trilobites described from Japan attain at present about 130 species in total among which 42 species are Carboniferous and 23 species Permian in age. In West Japan the Permo-Carboniferous trilobites were collected nearly all from calcareous rocks except for two imperfect pygidia. One is "Phillipsia" aff. middlemis from the Upper Permian Tsunemori series of the Akiyoshi district, Yamaguchi Prefecture (1985). The other is Griffithid gen. et sp. indet. from a phyllitic slate of the Tamba group at Minoo, Osaka Prefecture, which yields some corals and fusulinids in small limestones at a few places (1984).

Recently Yanai and Niko collected a small lot of trilobites together with crinoids, brachiopods and bivalves in alternating beds between acidic tuff and mudstone of the Arakigawa Formation at a place about 1.5 km Southeast of Hongo, Gifu Prefecture. These trilobites were afforded to the authors with geological information for which they record here best thanks to the collectors.

Of the Arakigawa Formation foraminifers, corals, bryozoans, brachiopods and other fossils have been collected and its age was first considered Lower-Middle Carboniferous by Fuzimoto, Kanuma and Igo (1962). Subsequently Igo (1964) has described Goniatites sp. indet. from a creek South of Hongo temple and concluded upper Visian for its age because of its alliance to Goniatites striatula and G. sphaericus. This chronology was upheld by Yamada and Yamano (1981).

The trilobite collection before hand consists of a cranidium, a hypostoma and several pygidia all deformed secondarily, but it looks best to locate in Paladin. Although the range of this genus extends from Lower Carboniferous (late Tournaisian) to Permian, it is noteworthy that it looks most similar to Paladin (Paladin) maillieuxi (Denmanet) which was described from the upper Visian of Belgium.

Family Phillipisiidae Oehlert, 1864
Genus Paladin Weller, 1936

In Japan the following four species belong to Paladin or its allies (1980, 1984).

Paladin carinatus Kobayashi and Hamada, 1980, from Hikoroichi, Setamai district, Kitakami Mountains; lower Visian
Paladin (?) mizunoi Kobayashi and Hamada, 1980, from Choanji, Kitakami Mountains; Tournaisian
Paladin sp. indet. from Yukizawa, Kitakami Mountains; upper Visian
Paladin (?) iwaizakensis Kobayashi and Hamada, 1984, from Iwaizaki, Miyagi Prefecture; late-middle Permian Iwaizaki limestone

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**Paladin hidensis** here described is the fifth species.

**Paladin hidensis**, sp. nov.

Figs. 1–5

*Description*—Cranidium with glabella nearly parallel-sided, slightly narrowing forward; basal lobe subtrigonal, fairly large, and isolated by diagonal posterior furrow; a pair of lateral furrows in front of basals a little shorter and parallel to them; occipital ring short sagittally, gradually narrowing laterally; its posterior margin nearly straight; axial furrows also nearly straight. Eyes half as long as glabella exclusive of neck ring. Anterior marginal furrow unusually concave, as long as anterior border which is crescentic and narrowing laterally. Anterior branches of facial sutures nearly straight, divergent almost as far as limits of eyes and suddenly bent inward at junction with marginal border and crossing it toward median point of anterior margin.

Figs. 1–5. *Paladin hidensis* Kobayashi and Hamada, sp. nov. 1: Holotype cranidium, internal mould, ×1.4. 2: Paratype pygidium, rubber replica of external mould, ×3.3. 3: Hypostoma, internal mould, ×10. 4a: Pygidium, rubber replica of external mould, ×4. 4b: Same pygidium, internal mould, ×4. 5: Two pygidia rectangularly, rubber replica of external mould, ×3.8.

Pygidium subtriangular, nearly as long as broad; its anterior margin broadly arcuate; lateral margin less arcuate and confluent with its counter to form rounded posterior margin. Axial lobe a little broader than a fourth of pygidium, regularly tapering back, composed of about 18 rings, well convex, prominently elevated above pleural lobes; axial furrow straight. Pleural lobe divided into seven ribs besides narrow first riblet; interpleural furrows narrow, terminating at junction with depressed marginal border of moderate breadth.
Observation:—The type cranidium on which the above description is based is an internal mould which is compressed diagonally. As the result the glabellar outline is deformed. The left axial furrow is straight, but the right one looks somewhat bent laterally along the margin of the basal lobe. Therefore the original glabella is probably somewhat expanded at the basal lobe, while it is regularly narrowing forward therefrom. Only two pairs of lateral furrows are recognizable on the glabella. The postero-lateral limb of the free cheek is too ill-preserved to figure out its outline.

Though imperfect a hypostoma reveals a relatively small subquadrate central body outlined by furrows. The anterior border is unusually well developed and probably auriculate laterally. The postero-lateral borders are narrow and united with each other behind the central body, thence forming a large tongue; a short median furrow issues from the posterior furrow.

Among the pygidia in the collection two are disposed rectangularly on a slab (Fig. 5). With this specimen it is understood that the original outline of the pygidium was intermediate between them, as exemplified by a paratype pygidium in Fig. 2. Another pygidium in Fig. 4, a-b shows the difference between the dorsal and ventral sides of the carapace as can be recognized by comparison between the internal mould and the rubber replica of the external mould of the same pygidium. The axial lobe has the rounded top, but its lateral slope is steep and its cross section may have been more or less trapezoidal. Minute ridges are alined on the top. The test of the pleural lobe is distinctly roughed by dense granulation.

Comparison:—In this species the glabella is not encroached into the frontal border as in Kaskia. The glabellar outline, isolated trigonal basal lobes and large posterior eyes are characteristics of the cephalon, combined with the pygidium surrounded by a depressed uniform marginal border as this species can be referred to Paladin (Paladin).

Its preglabellar area is distinctly concave as seen in latex cast of Paladin lutugini (Weber) in fig. 3, pl. 22, Osmolska, 1970. In a paratype cranidium of Paladin cervilanus (Weber), fig. 2, pl. 22, Osmolska, a similar aspect can be seen in the exfoliated part, but the frontal marginal furrow is narrow in the part of the actual dorsal surface. The median tubercle cannot be seen on the occipital ring in this species as well as P. lutugini on their internal moulds.

Like in Paladin eichwaldi parlis (Reed) this species has a posterior tongue in the hypostoma, but the central body is very small in this species.

This species has 7 to 8 pleural ribs on the pygidium, while 9 or more ribs are countable in many other species of Paladin. Like P. eichwaldi and P. belli 17 to 18 rings are present on the axial lobe of this species, but many others of the genus have no more than 15 ribs. Thus the axial lobe is comparatively multisegmented, while the pleural lobe is paucisegmented in this species. The uniform breadth of the depressed marginal border is another characteristic of this pygidium.

With regard to the least forward encroachment of the glabella, large eyes in posterior and the depressed uniform marginal border of the subtrigonal pygidium this species may be comparable with Paladin (Paladin) maillieuxi (Demanet, 1938) from the upper Visean of Belgium. The latter is, however, distinct from the former, because the anterior border is flat and the basal lobes are smaller in the cephalon and the interpleural furrows are visible on some anterior ribs and the axial and pleural lobes are composed of more than 15 rings.
and 10 ribs respectively in the latter species (Hahn, Hahn and Brauckmann, 1986).

Among the Japanese trilobites this species resembles *Paladin carinatus* and *Paladin (?) mizunoi*, but it can be easily distinguished from *P. carinatus* by the larger basal lobes and rough test and from the *P. (?) mizunoi* by the broader marginal border of the pygidium of this species (1980).

References