2. On some Lower Carboniferous Trilobites from the Hina Limestone, Okayama Prefecture, West Japan*

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In West Japan upper Visean or Onimaruan has once been thought the lowest fossiliferous horizon in the Carboniferous sequence (Carboniferous Research Committee, 1960), while Okimura (1958, 1963, 1967) pointed out that the Endothyra sp. A zone of the Akiyoshi limestone and Plectogyra communis and P. primaeva zones of the Atetsu limestone were lower Visean or even older. Recently Yanagida (1973) ascertained that Marginatia toriyamai, nov. from the Akiyoshi limestone group should be early Osagean or late Tournaisian in age. On the basis of the existing facts Ota (1977) classified the lowest part of the group as below.

*Millerella yowarensis* zone; upper Visean to lower Namurian  
*Nagatophyllum satoi* zone; middle to upper Visean  
*Zaphrentoides* sp. zone; lower Visean  
*Marginatia toriyamai* zone; upper Tournaisian

Then, whether or not, upper Tournaisian or older Carboniferous does occur at any other place in West Japan is an important question.

In their study of the Carboniferous trilobites in Japan the present authors found the following faunule in a collection from the Hina limestone at Hina, Yoshii town, Shitsuki county, Okayama Prefecture.* *

1. *Proetus (Pudoproetus) obsoletus*, sp. nov.
2. *Carbonocoryphe (Winterbergia ?) orientalis*, sp. nov.
3. *Griffithidella nishikawai*, sp. nov.

The first species (Fig. 2, magnification ×4.3) is diagnostic of *Pudoproetus* in most observable biocharacters. Compared to the American species it differs in weak lateral furrows anterior to the preoccipital one and the absence of granulation. The test is, however, smooth and lateral furrows are more obsolete in *Proetus eminens* Weber, 1937, from the lower Tournaisian of the Kirghiz Steppe which is now referred to this subgenus (G. & R. Hahn, 1969). The collection contains a large pygidium of *Pudoproetus* (Figs. 6 a, b,

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×1.5) which nicely agrees with that of early Kinderhookian *Pudoproetus missouriensis* (Shumard, 1855) in outline, convexity and mode of ribbing, although the marginal border is broader in this species, while the axial ring does not show such a sharp posterior crest as seen in that species. The pygidium presumably belongs to an identical species with the cranidium, though they are in different stages of growth. Incidentally, the pygidium of *Megaproetus cambriertus* Jell, 1977, can easily be distinguished from it by the unusually paucisegmented axis of this Lower Carboniferous species of Australia.

The second species (Fig. 4, ×5.0) is represented by a well preserved pygidium of *Carbonocoryphe*. This genus was recently splitted into four subgenera, viz. *Carbonocoryphe*, *Phillibolina*, *Aprathia* and *Winterbergia* (Hahn & Brauckmann, 1975). The Japanese species resembles *C. (A.) emanueli* R. & E. Richter (age: cu IIIα), but the marginal border is broader in that species. The pleural ribbing extends as far as the margin of the pygidium in *C. (C.) bindemanni* (cu IIIα), while this pygidium has a narrow marginal rim like *C. (W.) hercynica* G. Hahn (cu IIγ–IIIαz). The axial lobe is narrow in nearly all of the European species. In regard to the broad axis this species is comparable to *C. (W.) hercynica*, but the pygidium of that species is less segmented and the axial lobe is evidently much shorter, if compared to this species. This is quite a distinctive species, but it appears to be nearest to *Winterbergia* (cu II–III) among the existing subgenera.

The cranidium of the third species (Figs. 3 a, b, ×4.0) is similar to *Griffithidella doris* (Hall, 1860) as well as *Thigriffides roundyi* (Girty, 1926) in outline and convexity of the cranidium and glabella and the narrow frontal border and fixed cheeks. The lateral furrows
on the glabella is evidently weaker in *G. nishikawai* than *G. doris* and somewhat stronger in it than *T. roundyi*. Compared to these allies the palpebral expansion of the fixed cheek appears narrower in this species. In this aspect it resembles *Griffithidella welleri* (Branson & Andrews, 1938).

The cranidium of the fourth species (Figs. 1 a, b, ×4.3) differs from the preceding in the more quadrate glabella. In less rounded anterior outline, more gentle convexity of the frontal lobe, obsolete lateral furrows and smooth test it agrees better with late Kinderhookian *Thigriffides* than *Griffithidella*. A subtriangular pygidium (Figs. 5 a, b, ×2.5) in hand is very much like that of *Thigriffides roundyi*.

Now the geological range and geographical distribution will be outlined of these genera and subgenera. *Pudoproetus* was created by Hessler (1963) as a subgenus of *Proetus*. Its age is from lower Kinderhookian through lower Osagean, if *Proetus (Pudoproetus) hahni* Chamberlain, 1977, the solitary survivor in the Moscovian of Ellesmere Island is excluded. It was distributed widely in the United States on one side and in the Urals, the Kirghiz Steppe, the Altai, Turkestan and further in Australia (New South Wales) on the other. It appeared already in the Etroeungtian in the Urals and most flourished in the early Tournaisian age (Hahn, 1969).

Upper Kinderhookian *Thigriffides roundyi roundyi* (Girty, 1926) is the type-species of *Thigriffides*. It is a rare genus, but its close ally is *Griffithidella* which is widely spread in the upper Kinderhookian and lower Osagean rocks. According to G. & R. Hahn (1970) *Griffithidella* in which they include *Thigriffides* as a subgenus is distributed not only in North America but also in the Soviet Union in the upper Tournaisian and lower Visean times and further into Australia.

According to Hahn and Brauckmann (1975) *Carbonocoryphe* is a middle and upper Dinantian genus except for *C. (Aprathia) bifurca* which survived until early Namurian from Visean. The known occurrences of the genus have been restricted to the area from Spain to the Urals through North and Central Europe (England, West Germany and Mähren). Therefore this is the first record of occurrence outside the above domain. The Japanese species is, however, not diagnostic of any of its four subgenera. Nevertheless it agrees best with the subgenus *Winterbergia* which reveals the trunk of the genus most flourished in late Tournaisian. Therefore *C. orientalis* would be an isolate branch issued from the trunk in the early stage of the generic evolution.

Insofar as one can judge from the above generic composition the
age of the Hina trilobite faunule is definitely within the range from Tournaisian to lower Visean or from Kinderhookian to lower Osagean. If the specific alliance and the generic or subgeneric acmic prominence are brought into consideration, the age in question must be middle or upper Tournaisian and upper Kinderhookian of North America. In other words, this is the second record of the Tournaisian horizon in West Japan which would be possibly a little older than the Marginatia toriyamai zone, if the lower Osagean age of the brachiopod is taken into account.

It was about fifty years ago that Nagatophyllum satoi was identified by Ozawa in a collection from the Hina limestone (Akagi, 1930). Ozawa (1925) considered N. satoi to be a Dinantian coral, and its age is now dated by Ota at middle to upper Visean in the Akiyoshi zonation. Therefore, the Hina trilobite horizon must be below the satoi horizon. The cliff-making Hina limestone, 80 m or thicker thrusts itself upon the Noric Nariwa Series on the south side (Nakano, 1952). The trilobite locality lies in the lower part of the limestone. Unfortunately the N. satoi horizon was not exactly located within the limestone. The precise zonation of the Hina limestone and its exact correlation to the lower part of the Akiyoshi limestone group are two important problems for the Dinantian biostратigraphy of Japan.

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References
