On *Lonsdaleoides nishikawai* n. sp.

(An Upper Palaeozoic Fauna from Miharanoro, Hiroshima Prefecture, Japan 2nd Note)

by

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(with 3 Text-Figures and 1 Plate)

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Family Geyerophyllidae MINATO 1955

Genus ***Lonsdaleoides*** HERITSCH 1936

Type Species: *Lonsdaleoides boswelli* HERITSCH

Generic diagnosis: Wall thick with septal ridges. Columella of amygdallophylloid type in early stage, and carcinophylloid or axolithophylloid type in mature stage. Clinotabulae conspicuous, but elongate dissepements are not well recognized. Septa in diffusotrabecular in structure.

Remarks: Notwithstanding the formation of clinotabulae, the nature of columella is entirely different from that of waagenophyllids; besides, columella is solid in early stages. From these features the presnet genus cannot be grouped with either Waagenophyllidae or Lonsdaleiidae. The columella of this genus had been diagnosed by both HERITSCH (1936) and MINATO (1955) to be continuous with the counter-septum, while DE GROOT (1963) described that the connection is with cardinal septum. To this notion we agree. Similar features are recognized in *Carinthiaphyllum*, *Carniaphyllum* and *Geyerophyllum*, all what were included by MINATO in his Geyerophyllidae, although the situation is not obvious with respect to the genera *Akiyosiphyllum* and *Cionodendron*. Generally speaking, however, in majority of the genera of Geyerophyllidae, it may be quite safe that columella is connected, not with counter-septum but with cardinal septum. Consequently, it may not be unanimous to assume Geyerophyllidae to have descended from the corals of the type of *Lophophyllidium*.

The type species of *Lonsdaleoides*, *L. boswelli* was described to be fasciculate in growth by the original author. In the works of MINATO (1955) and MINATO and KATO (1958) *L. enormis* (OZAWA) and *L. toriyamai* MINATO were diagnosed also to be fasciculate. Besides, De GROOT's *L. hispanicus* (1963) also is fasciculate in growth. Of these four forms, only the last named species and *L. toriyamai* are

obviously fasciculate forms. HERITSCH descibes the type species "strauchartig wachsende Koralle", and three individuals in one section are shown in the text-figure plate. That they are three individual corallites of a fasciculate corallum does not seem to be found in the text. Could it not be possible that three individuals of solitary corallites together cut across? As to the growth form of the type species, we are inclined to feel that there remains some doubt.

That the coral from Miharanoro, now under consideration, there is no doubt, that the inner structure is very much like that of *L. boswelli*, in the fundamental features. If, however, the type species is of fasciculate form, the generic identification between it and the Miharanoro coral may not be readily recognized, in spite of the likeness of the inner structure.

On the other hand, MINATO and KATO (1965a and 1965b), in their course of studies on Waagenophyllidae and Durhaminidae, carried on detailed observations on the problem of growth forms of corallites, drew the conclusion that they should be weighed appropriately as a factor of classification.

Aside from the difference in growth forms, however, the present fossil is hardly distinguishable from the type species of HERITSCH. In the figured specimen, the median plate is not distinctly recognized, but this may possibly be due to its being in a very early part of the ephebic stage: to the same cause may be the unusual thickness of septa due.

Provided that the figure of the type species given by HERITSCH represents the mature stage of growth, this and the present Japanese species will have to be distinguished by the difference of thickness of septa, as well as by the presence or absence of the median septum. Moreover, the zone of lonsdaleoid dissepiments is wider in the former than in the other, provided that the two are at about the same stage of growth.

The Spanish Carboniferous species *L. hispanicus* DE GROOT appears to be typically fasciculate in growth, as is shown by the author in transverse sections on the plate. It differs from the Miharanoro species in developing shorter minor septa: besides, the lonsdaleoid dissepiments are not so dense in the former as in the latter, and the tabellae of axial structure also are a little developed in the former.

Lonsdaleoides nishikawai n. sp.

Plate 33, Text-figures 1–3

Four specimens are at disposal: trochoid in form, slightly curved, cardinal quadrants on convex side, and counter quadrants on the concave: with evidence of slight degree of rejuvenation of corallite. Calyx appears to be rather shallow: its diameter measured along alar septa is about 18.0 mm.

One* of the three specimens was polished by NISHIKAWA to examine the septal

* UHR 18485, holotype

and other structures. Of this specimen several transverse (starting with this polished surface) and longitudinal slides—thin sections and replicas—have been prepared in order to examine ontogeny—neanic to ephebic stages. The growth stages will be briefly described one after another. Before describing the stages in order, abbreviations of terms used are explained. Position of thin sections and replicas of the specimen is shown in the diagram (see p. 276).

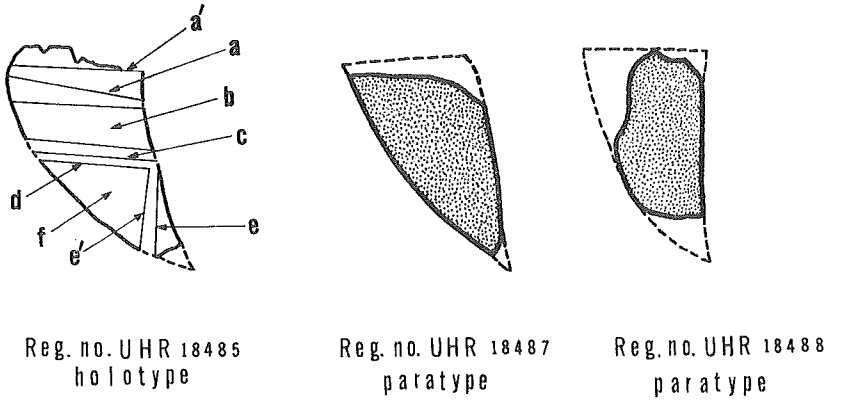


Fig. 1
Shape and size of specimens of *Lonsdaleoides nishikawai* HAYASAKA et MINATO, sp. nov. showing positions from which thin sections and replica films have been taken.

Serial Transverse Section

e section. Neanic stage.
Calicular diameter 11.5 mm (alar-direction)
Septa in distinct bilateral symmetry.

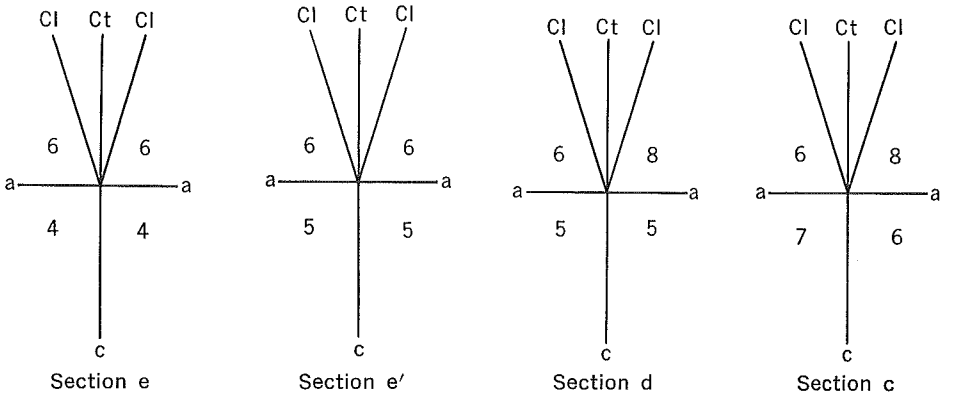
Most of the major septa, except a few, reach to columella: thick minor septa begin to develop between the major, some being still incipient. Columella with its axis tending toward counter septum, is of elliptical outline in cross section; median plate and lamellae are indistinct, being almost solid; the amygdallophylloid type.

Septa are completely united on approaching the outer wall, and form thick and long stereowall or septal wall: non-septate area lacking. No dissepiments appear at this stage.

e′ section. Neanic stage
Calicular diameter, 12.0 mm.
Cardinal quadrants; increase in number of septa; minor septa more uniform in growth. Septa grow thick in stereowall. Median plate in columella not recognized.

d section. Neanic stage
Increase of septa in counter quadrants.
Wall constructed in part with long, mural septa; other parts begin to assume wide, semicircular mural septa, i.e., beading type mural septa on the cardinal side; this is due to the obliquity of the cut-edge: in the cardinal side lonsdaleoid dissepiments are seen, at this stage though very rarely. Columella is solid, and its median plate is rather obscurely observed. Both major and minor septa are thickened in the neighborhood of where dissepimental and medial zones meet, and they show a tendency to become somewhat thinner in the peripheral zone.

Diagram of Septal increasing



a—a	alar septa
C	Cardinal septum
Ct	Counter septum
Cl	Counter-lateral septa
Numerals	number of septa in respective quadrants.

c section. Latest neanic stage. Calicular diameter 16.0 mm.
Septa increased in number both in the cardinal and counter quadrants. Septa are thickest at this stage: wall is still strengthened by long mural septa, and the part of the septal wall with beading type pattern is slightly widened. Dissepiments are dense, and arranged concentrically, but lonsdaleoid dissepiments are still only very rarely recognized.

a section. Ephebic stage. Calicular diameter 18.0 mm. (this is almost at the surface polished by NISHIKAWA, as stated above). At this stage septa, as a whole, become thinner and tend to take radial symmetry instead of bilateral: minor septa

fully developed. Columella leaves off from septa, and, beside the median plate lamellae also become apparent. Lonsdaleoid dissepiments are increased. The wall assumes the beading type pattern throughout.

Going through with these cross sections, the following facts are recognized according as the coral grows, namely,

1. Counter septum is short.
2. Alar fossulae are conspicuous in early stages.
3. Columella varies in form from solid type through amygdallophylloid and carcinophylloid or axolithophylloid types.
4. Tabellae of axial structure are scarcely recognized even at the mature stage of growth.

The uppermost of the transverse sections examined, is close to the surface polished by NISHIKAWA, as stated above. The naturally exposed calicular surface appears to be preserved in the piece of this specimen cut off by NISHIKAWA. In this top-most portion of the corallite a few offsets are recognized: they are situated inside the peripheral zone (lonsdaleoid dissepiments), and with rather thick walls and the solid columellae show the earliest stage of development. These offsets may grow either into cerioid type, or may further into the fasciculate. These features are all shown in a transverse sections a′.

Observations on the longitudinal Sections

Two longitudinal thin sections were made, b and f. The former is across the upper end of the corallite, made very close to the surface polished by NISHIKAWA before the fossils were sent to HAYASAKA. The other cuts through a little above the base.

As far as has been observed in these sections, the wall is not recognized. Peripheral area is occupied by large lonsdaleoid and globose dissepiments, with all their convex sides faced upwards and inwards. Elongate dissepiments are likely to be lacking.

Tabularium is rather well spaced, is occupied by a few strongly inclined clinotabulae which directly unite with transverse tabulae by their inner margin, showing smooth curve. Columella is almost solid, and septal lamellae and median plate are hardly distinguished as such from each other.

Of the other specimens, paratypes, a few words, in part as supplements to the foregoing observations, will be added in this place. These paratype specimens are trochoid in form like the holotype, with apical angles of ca. 40°. One of them (UHR 18487) preserves an almost complete but shallow calyx, in which a rather thick peripheral zone of well developed lonsdaleoid dissepiments, and septa and

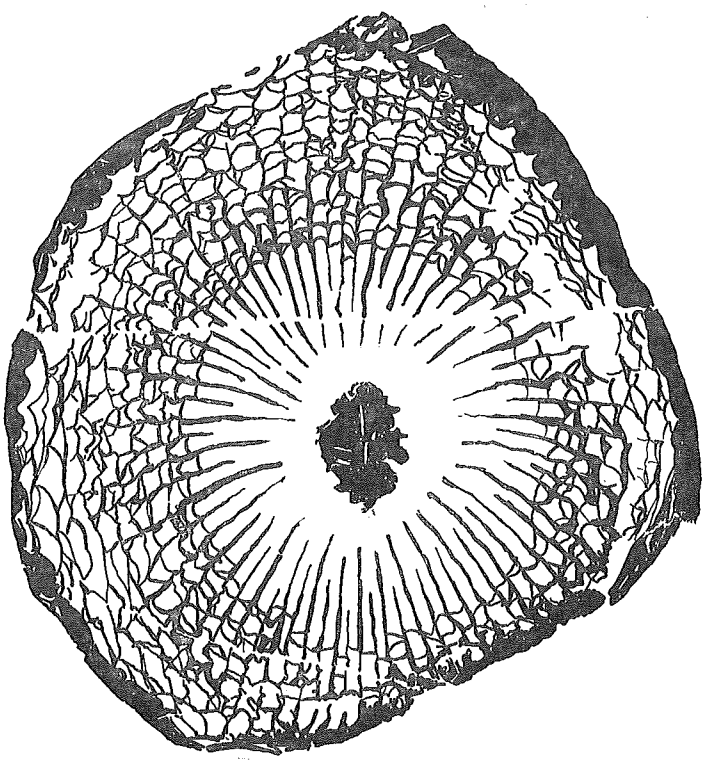


Fig. 2
Lonsdaleoides nishikawai HAYASAKA et MINATO, sp. nov. (×5.8) UHR 18485-a (Holotype)

columella within. Columella is not prominent; this specimen preserves most of the apical part. The other paratype specimen (UHR 18488) is broken in part and less well preserved, but the general form of the same type as the other.

The other specimen (UHR 18486) is a thin slide made from a fragmentary piece of limestone: it was cut across at a random orientation. It is observed that the septa are still far thicker than those in the ephebic stage observed in other specimens. This seems to show that this specimen represents the early ephebic stage of development.

Locality: 2045 of Mr. I. NISHIKAWA; associate fossil, *Triticites* sp.

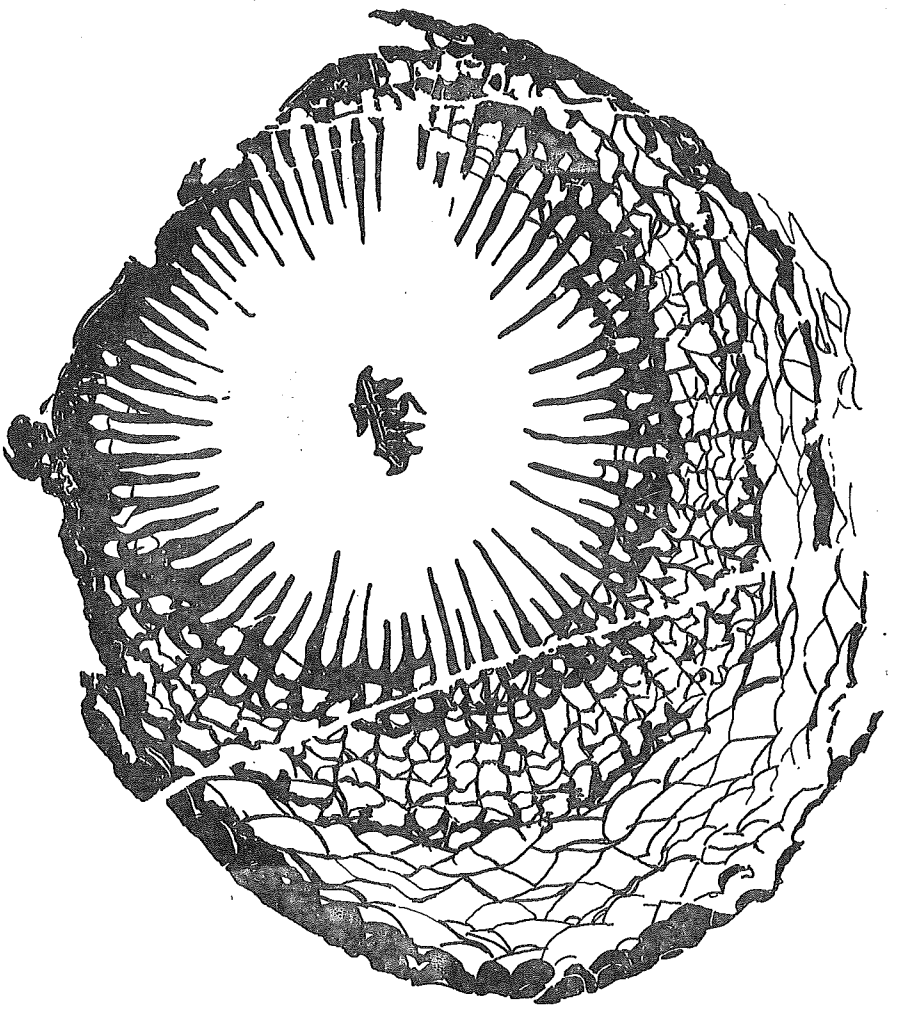


Fig. 3
Lonsdaleoides nishikawai HAYASAKA et MINATO, sp. nov. (×7.4) UHR 18486 (Paratype)

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PLATE AND EXPLANATION 33

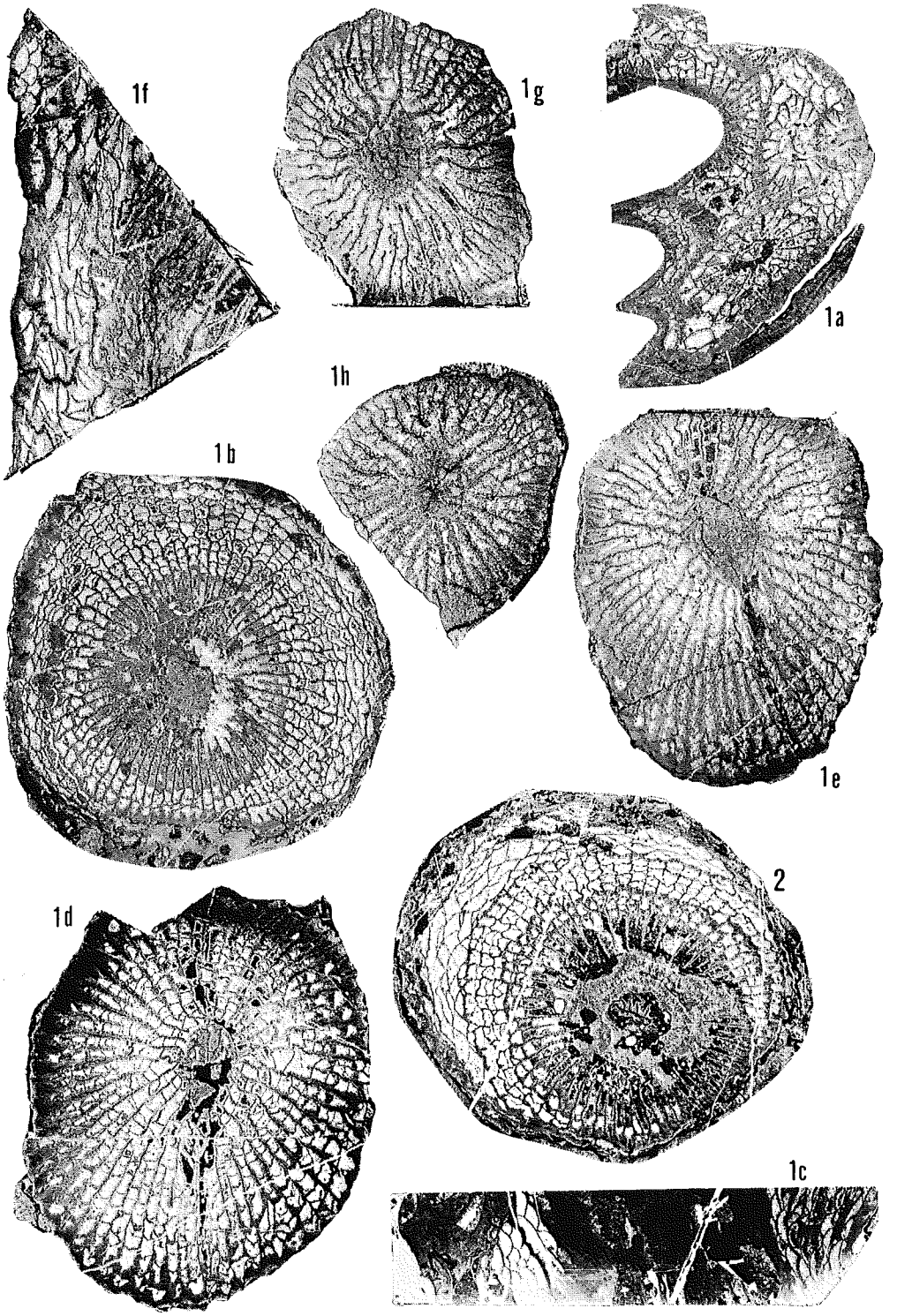
Explanation of Plate 33

(All figures about 3.5 times natural size).

Figs. 1a-h. *Lonsdaleoides nishikawai* HAYASAKA et MINATO, sp. nov.
1a-transverse section showing budding (thin section á,) ; 1b-transverse section showing the development of lonsdaleoid dissepiments (replica film a) ; 1c-longitudinal section (thin section b) ; 1d-a little obliquely cut transverse section (thin section c) ; 1e-obliquely cut transverse section (replica film d) ; 1f-longitudinal section (replica film f) ; 1g -transverse section (replica film e') ; 1h-transverse section (replica film e) UHR 18485-Holotype. Loc. 2045, Miharanoro.

Figs. 2. *Lonsdaleoides nishikawai* HAYASAKA et MINATO, sp. nov.
Transverse section at calicular portion. UHR 18486-Paratype. Loc. 2045, Miharanoro.

Plate 33



S. KUMANO photo.