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# RECORD OF CARNIAN CONODONTS FROM THE TOP OF KALAPANI LIMESTONE KUMAUN HIMALAYA, INDIA

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ABSTRACT

The top of Kalapani Limestone in Yong Valley Malla Johar has revealed a distinct Carnian assemblage which is characterized by *Epigondolella carnica* Krystin, *Neogondolella foliata* (Budurov), *N. tadpole* (Hayashi), *N. polygnathiformis* (Budurov & Stefanov) and *Gladigondolella malayensis* Nogami. Conodont fauna suggests that the upper age of Kalapani Limestone in the investigated sequence can not be younger than Julian. Such an assemblage is known only from Southeastern Europe and Turkey. Biostratigraphic implications of the conodont fauna are briefly discussed.

## INTRODUCTION

In recent years, conodont biostratigraphy of the Himalayan Trias has become a subject of interest for many workers in India and abroad. At present, the occurrence of conodonts has been recorded from a number of stratigraphic horizons in different parts of Himalaya. Although, Lower and Middle Triassic conodonts have been recorded in a number of papers but Upper Triassic conodonts particularly from Carnian horizons are inadequately known and are reported only in a few papers (Gupta & Rafek, 1976; Goel, 1977; Gupta, 1983). This paper has special significance firstly because it increases our knowledge of the Julian conodont elements of the Tethyan open-sea facies from Himalaya and secondly, recovered conodonts come from the uppermost part of the Kalapani Limestone. Thus they shed more light on the upper age of Kalapani Limestone. Incidently, this is the first report of Carnian conodonts from Kumaun Himalaya.

Work on a new research project entitled "Conodont biostratigraphy and micropalaeontology of Triassic Sections of Malla Johar, Tethys Himalaya" has recently been started in the Geology Department, Lucknow University. The area of conodont investigation has been studied by one of us (S. K.) who was a member of two expeditions of the Wadia Institute of Himalayan Geology, to Malla Johar area during 1972-73. Samples for the present study were collected by one of the authors (S. K.) along with Dr. M. P. Singh of Lucknow University during June-July, 1982.

A large number of samples were processed for conodont biostratigraphic and micropalaeontologic work. Acid etching has brought to light rich conodont assemblages associated with foraminifera, ostracoda, microfish remains, micromolluscs and holothurian sclerites in a number of horizons in the Chocolate Formations and the Kalapani Limestone. However, in the present paper, conodont fauna from two samples (KP. 1 & KP. 2) from the uppermost part of Kalapani Limestone exposed at a place 7.4 Km. from Sumna on Sumna-Rimkhim mule track in Yong Valley (Fig. 1) has been reported and its biostratigraphic significance discussed.

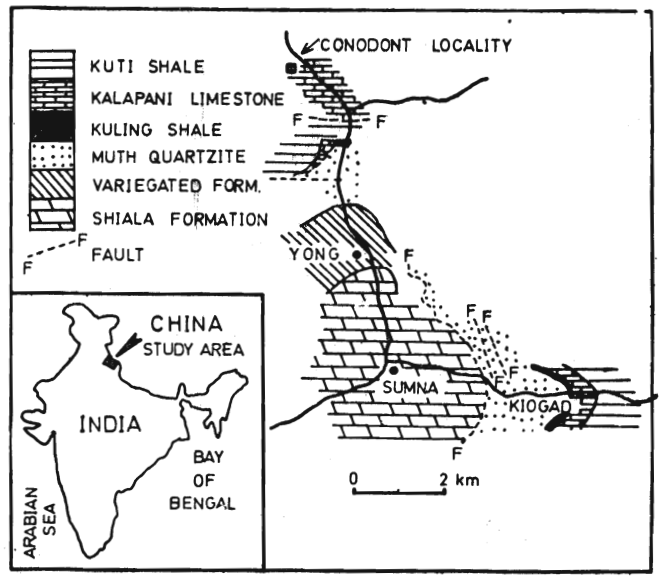


Fig. 1. Geological map of Yong Valley, Malla Johar showing Conodont locality. The Kalapani Limestone includes the Chocolate Formation.

## STRATIGRAPHY OF THE STUDY AREA

In the area of investigation, the marine Triassic rocks are represented by the Chocolate Formation, the Kalapani Limestone, the Kuti Shale, the Passage Formation, and the Kioto Limestone (Heim and Gansser, 1939; Kumar *et al.*, 1977). Lithostratigraphy of the area is given in Table 1. The Kalapani Limestone sequence regarded as condensed sequence representing Anisian, Ladinian and Carnian Stages of the Alpine region (Heim & Gansser, 1939) is Ca. 25 metres in thickness. It conformably overlies the Chocolate Formation and grades into the Kuti Shale Formation. The lower part of the Kalapani Limestone is grayish-black compact limestone, partly nodular and interbedded with light to dark gray shales. In the upper part shale content increases and is intercalated with bands of shell limestone.

## CONODONT INVESTIGATIONS IN THE TRIAS OF MALLA JOHAR

The Triassic sediments of Malla Johar have revealed the presence of conodonts and associated microfossils. Gupta (1972) was first to report the presence of conodonts in the Lower Triassic rocks near Kalapani village. Subsequently, Chhabra *et al.*, (1973) reported Middle Triassic conodonts from the Kalapani Limestone sequence near Sumna area in Kiogad Valley. Later from the same material, Sahni and Chhabra (1974) described and illustrated forty five species representing fifteen genera. Chhabra and Sahni (1981) re-examied Sumna material and assigned Upper Bithynian or Early Pelsonian age to the conodont bearing horizon on the basis of association of *Neogondolella constricta* (Mosher & Clark), *N. bulgarica* (Budurov & Stefanov) and *N. nitiensis* (Misra, Sahni & Chhabra).

The only report of Upper Triassic conodonts from Malla Johar area is by Gupta *et al.* (1978). They have recorded the occurrence of Upper Norian (Alaunian) conodonts from marly horizon at the base of Kioto Limestone near Kuti. The age of the conodont bearing horizon according to the authors is "within the ammonoid zone of *Cyrtopleurites bicrenatus* of Gazdzicki *et al.* (1979)".

## CONODONT FAUNA AND BIOSTRATIGRAPHIC SIGNIFICANCE

Recovered conodont fauna is moderately well preserved and also shows some diversity of the forms. Of the two conodont producing samples, one (KP. 1) is an argillaceous limestone at the top of Kala-

Table 1. (After Kumar *et al.* 1977)

| Super group | Group | Formation | Member | Lithology | Age |
|---|---|---|---|---|---|
| SUPER GROUP | RAWALIBAGAR GROUP | Ferruginous Oolite Formation 10 m | | Ferruginous oolitic limestone and shale with abundant ammonites. | Callovian |
| | | Laptal Formation 70 m | | Shell limestone, limestone, oolitic limestone, marls and shales. | Liassic |
| | | Kioto Limestone | Kioto D 30 m | Oolitic limestone and shell limestone. | Rhaetic |
| | | | Kioto C | Limesstone, shell limestone and shale. | |
| | | | Kioto B 30 m | Nodular limestone | |
| | | | Kioto A 30 m | Oolitic limestone, limestone and shale. | |
| | | Passage Formation 90 m | | Shell limestone, limestone, silty shale and orthoquartzites. | |
| | | Kuti Shale | Kuti C 100 m | Silty shale and sandy limestone. | Noric |
| | | | Kuti B 280 m | Greyish black friable shales with hard calcareous shales. | |
| | | | Kuti A 130 m | Black friable shales and shaly limestone. | |
| MALLA JOHAR | | Kalapani Limestone 25 m | | Limestone, shell limestone and shales with abundant ammonites. | Anisic to Carnic |
| | | Chocolate Formation 7 m | | Limestone, with black shales. | Scythic |
| | | Kuling Shale 27 m | | Black shales with subordinate siltstones. | Permian |

pani Limestone. Other sample KP. 2 is bluish-gray, biomicritic limestone collected 0.5 metres below the sample KP. 1 (Fig. 2). The conodont assemblage

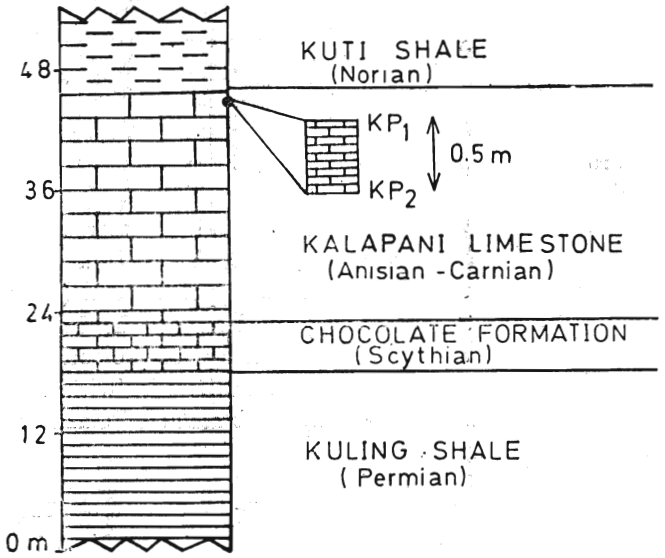


Fig. 2. Lithology of Kalapani Limestone showing position of Conodont bearing samples.

includes following platform conodont species: *Neogondolella polygnathiformis* (Budurov & Stefanov), *N. foliata* (Budurov), *N. tadpole* (Hayashi), *Epigondolella carnica* Krystin and *Gladigondolella malayensis* Nogami. Besides the platform conodont elements, the conodont fauna also includes ramiform elements such as *Enantiognathus ziegleri* (Diebel), *Cypridodella muelleri* (Tatge), *C. conflexa* Mosher, and *Diplododella acroforme* (Mosher & Clark) and *Cratognathodus* sp. The number of specimen of each platform conodont species in two samples is given in Table 2.

Table 2.

| S. No. | Name of the species | Sample no. KP. 1 | KP 2 |
|---|---|---|---|
| 1 | *Epigondollela carnica* Krystin | 1 | — |
| 2 | *Gladigondollela malcyensis* Nogami | 1 | — |
| 3 | *Neogondolella tadpole* (Hayashi) | 1 | — |
| 4 | *N. polygnathiformis* (Budurov & Stefanov) | 2 | 3 |
| 5 | *N. foliata* (Budurov) | 2 | 4 |
| 6 | *N.* cf. *faliata* (Budurov) | 1 | — |
| 7 | *N.* sp. (Early growth stage) | 1 | — |
| 8 | *N.* sp. (Indeterminate fragments) | 7 | 10 |
| 9 | Ramiform elements | 20 | 14 |

In the conodont fauna, two species of the major stratigraphic value are *Epigondolella carnica* Krystin (Pl. I—16, 17, 18) and *Gladigondolella malayensis* Nogami (Pl. I—21, 22). *E. carnica* evolves from *Neogondolella auriformis* group and according to Krystin (1983), it is restricted to Julian. *G. malayensis* which is most characteristic of Tethyan provinces, becomes extinct at the top of Julian (Kovacs & Kozur, 1980; Kozur, 1980). At present, occurrence of *G. malayensis* is known from Austria, Hungary, Yugoslavia, Bulgaria, Turkey, India, Nepal, Thailand Malaysia and Japan.

Other three platform conodont species of the assemblage i.e., *N. foliata* (Budurov), *N. polygnathiformis* (Budurov & Stefanov) and *N. tadpole* (Hayashi) are also biostratigraphically significant. *N. foliata* is known from Europe and Japan and its stratigraphic range is from Langobardian through Julian (Kovacs & Kozur, 1980). It was originally described by Budurov (1975) from the sequence referable to Langobardian in Bulgaria. Recently, Kovacs (1983) has studied the evolutionary developments in *N. foliata* and he is of the opinion that it is not intermediate between *N. excelsa* and *N. polygnathiformis*. His study reveals that at the beginning of the Langobardian substage, *N. foliata inclinata*, evolved from *N. excelsa*. In Upper Langobardian, *N. foliata inclinata* gave rise to two evolutionary lineages: 1. N. *foliata foliata-tadpole* line 2. *N. polygnathiformis* line which continued in the Norian *N. navicula* group. According to Kovacs (1983), both the subspecies become extinct at the top of Julian. Our material also includes the forms transitional to *N. tadplole*. (Pl. I—2-3)

A lone specimen LUGD 23013 (Pl. I—11, 12, and 13) in the assemblage is probably the adult stage of *N. foliata*. It has a greater width and is characterized by the platform which is robust, pitted and is squared off at the posterior end. Cusp is robust and largest denticle in the posterior 2/3 of the specimen. This form resembles with *N. navicula* illustrated by Kolar-Jurkovsik (1983) from *Halobia* bearing Tuvalian sequence in western Pokljuka Plateau, Yugoslavia. The main difference between Kalapani material and Yugoslavian material is that the posterior platform is present in greater area behind the cusp in Yugoslavian material.

Another specimen LUGD 23014 (Pl. I—6, 7, 8) in the conodont fauna of Kalapani Limestone, in our opinion, is the hyper adult stage of *N. foliata*. Posterior end of the specimen is squared off with distinct excentricity. Platform is tapering progressively towards anterior end. It appears to be morphologically close to some forms described by Mosher (1968, Pl. 118, Figs. 17 and 19) as *Gondolella polygnathiformis* from the Upper Carnian of California, U.S.A. in the general characters of platform, keel and basal pit and squared

off posterior end. The Kalapani material differs significantly from Mosher's material by more tapering platform, greater excentricity of posterior end and by greater length to width ratio.

*N. polygnathiformis* has world wide distribution. It was first described by Budurov & Stefanov (1965) from Lower Carnian *Trachyceras* Zone in Bulgaria. Mosher (1968), Sweet *et al.*, (1971) considered this species to be of major stratigraphic importance only in Upper Carnian. *Tropites* bearing Upper Carnian strata at Someraukogel and Feuerkogel in Austria and Horselkus Limestone in north California, U.S.A. were assigned to *Paragondolella* (=*Neogondolella*) *polygnathiformis* Zone by Mosher (1968). Now it is known that this form occurs throughout the Carnian (Krystin, 1980; Koike 1981; Isozaki and Matsuda 1982). According to Krystin in (Balogh & Kovacs, 1981) first appearance of *N. polygnathiformis* marks the beginning of Carnian. It disappears at the Carnian-Norian boundary. (Krystin, 1974). In the present assemblage *N. polygnathiformis* is represented by forms showing typical honey comb structure (Pl. I—1) and also by forms transitional to *N. noah* (Hayashi) (Pl. I—9, 10).

*N. tadpole* which is characterized by "tadpole" shaped platform, was originally described by Hayashi (1968) from Adoyama Formation in Ashio Mountains, Central Japan. Its stratigraphic range is from Cordevolian through Basal Tuvalian (Kovacs & Kozur, 1980). According to Kovacs (1983) it is so for known only from the Tethyan provinces (except Mediterranean *sensu* Kozur, 1973).

The present conodont funa whish is characteristic of Tethyan opean sea facies suggests that on the basis of the stratigraphic ranges of *E. carnica*, *N. tadpole* *N. foliata* and *G. malayensis*, the age of the top of Kalapani Limestone in the investigated section cannot be younger than Julian (*N. auriformis* Zone of Krystin, 1983). More or less similar association of Julian conodonts (*N. foliata foliata*, *N. polygnathiformis*, *N. tadpole* and *G. malayensis*) has also been reported by Balogh and Kovacs (1981) from Szolosardo Marl Formation in the bore hole sequence of Szolosardo in northern Hungary.

It should be mentioned that Heim and Gansser (1939) had stated the presence of *Tropites* in the uppermost part of Kalapani Limestone in certain sections of Malla Johar. In the investigated section, uppermost part of Kalapani Limestone has not been searched for ammonoids but conodont fauna indicates a definite Julian age. It is a preliminary report and a detailed work on the upper part of Kalapani Limestone of different sections is presently in hand and a final report will be published on this problem in future which is bound to reveal more information about the present fauna known so far from southeastern Europe and Turkey.

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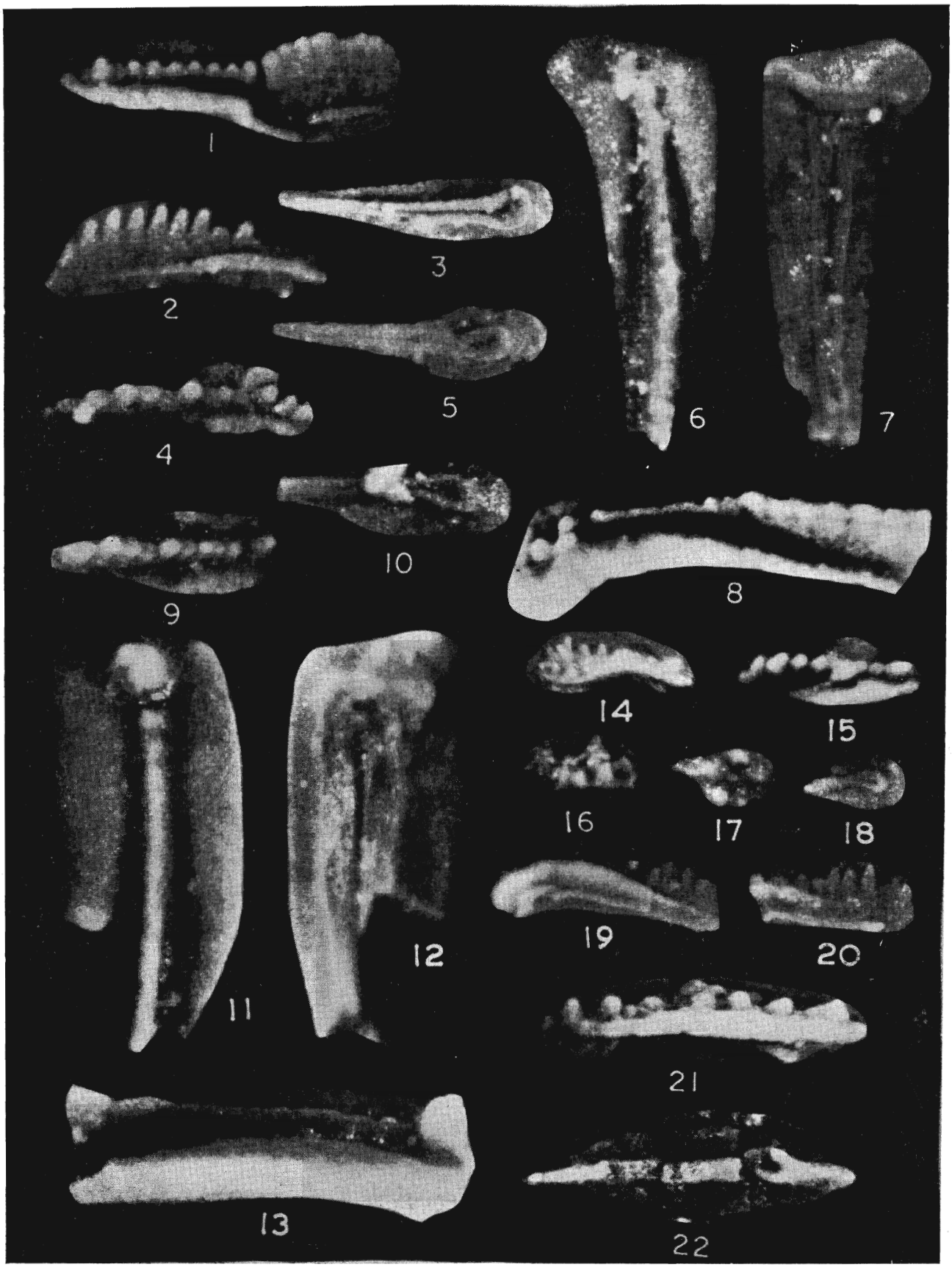
## EXPLANATION OF PLATES

### PLATE I

(All figures X 75 except 19)

1. *Neogondolella polygnathiformis* (Budurov & Stefanov). Oblique Oral view, LUGD 23012, KP. 2.
2—3. *Neogondolella foliata foliata* (Budurov) transitional to *Neogondolella tadpole* (Hayashi). Lateral and Aboral views, LUGD 23010, KP. 2.
4—5. *Neogondolella tadpole* (Hayashi), Oral and Aboral views, LUGD 23011, KP. 1.
6, 7 & 8. *Neogondolella foliata* (Budurov), Hyper adult stage, Oral, Aboral and Lateral views, LUGD 23014, KP. 2.
9. 10. *Neogondolella polygnathiformis* (Budurov & Stefanov) transitional to *Neogondolella noah* (Hayashi). Extreme anterior end broken. Oral and Aboral views, LUGD 23007., KP. 1.
11, 12& 13. *Neogondolella* cf. *foliata* (Budurov), Adult stage, Oral, Aboral and Oblique Oral views, LUGD 23013, KP. 1.
14 & 15. *Neogondolella foliata* (Budurov) transitional to *Neogondolella polygnathiformis* (Budurov & Stefanov), growth stage, Lateral Oral views, LUGD 23006, KP. 2.
16, 17 &18. *Epigondolella carnica* Krystin, Early growth stage, Oblique Oral, Oral and Aboral views, LUGD 23008, KP. 1.
19. *Neogondolella foliata* (Budurov), Aboral-lateral view (×50), LUGD 23002, KP. 1.
20. *Neogondolella* sp, Early growth stage, Lateral view, LUGD 23005, K P. 1
21, 22. *Gladigondolella malayensis* Nogami, Lateral and Aboral views, LUGD 23020, KP. 1.

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