



ON *CLARAIA* OF KASHMIR AND IRAN

KEIJI NAKAZAWA

DEPARTMENT OF GEOLOGY AND MINERALOGY, KYOTO UNIVERSITY, JAPAN

ABSTRACT

The Lower Triassic bivalves are almost exclusively represented by *Claraia* and *Eumorphotis* in Kashmir, India, and by *Claraia* in Julfa and Abadeh regions, Iran. The following species of *Claraia* have been discriminated in the two provinces: *C. aff. extrema*, *C. dieneri*, n. sp., *C. bioni*, n. sp., *C. n. sp. ind.*, *C. concentrica*, *C. cf. griesbachi*, *C. decidens* in Kashmir; and *C. clarai clarai*, *C. clarai desquamata*, *C. aff. dalpiazzi*, *C. extrema*, *C. radialis julfensis*, n. subsp., *C. intermedia*, *C. aff. stachei*, *C. aurita* in Iran. The Kashmir fauna of *Claraia* is related to that of East Tethys. On the other hand, the Iranian fauna is closely connected with that of the Mediterranean province.

The genus *Claraia* has been classified into four groups, that is, *clarai*, *stachei*, *aurita*, and *decidens*. The first three groups can be each subdivided into two subgroups, auriculate and non-auriculate or obscurely auriculate ones. The former evolved from the latter in the Upper Griesbachian. The group of *stachei* is considered to have originated in pseudomonotids in the Late Permian as represented by the latest Permian species, *Claraia bioni* in Kashmir.

Lastly the description of *Claraia* from Kashmir and Iran are given.

INTRODUCTION AND ACKNOWLEDGEMENTS

The genus *Claraia* is referred to as one of the important molluscs of the Lower Triassic. During the survey on the Permian-Triassic sequences in Kashmir and Iran supported by the Ministry of Education, Japan, Geological Survey of India, and Geological Survey of Iran, the author collected many specimens of *Claraia* in cooperation with his co-workers.

In Kashmir of India, the best succession of the Permian-Lower Triassic strata is exposed at Guryul ravine and a spur 3 km north of Barus near Srinagar. The Lower Triassic group named the Khunamuh Formation is divided into six members, from E to J, at Guryul ravine section, of which basal part belongs to the uppermost Permian (Nakazawa *et al.*, 1975). The formation consists mostly of alternations of limestone and shale, increasing the amount of limestone upwards. Ammonoids, bivalves, and conodonts are commonly found in it. Several ammonid zones can be established in the Khunamuh, that is, *Otoceras-Glyptopliceras*, *Ophiceras*, *Paranorites-Vishnuites*, *Prionites-Koninckites*, and *Owenites-Kashmirites*, in ascending order. Bivalves are mostly represented by *Claraia* and *Eumorphotis*, of which the former is mainly found in shales. The following species of *Claraia* could be identified:

Claraia aff. extrema Spath, *C. dieneri*, n. sp., *C. bioni*, n. sp., *C. n. sp. ind.*, *C. concentrica* Yabe, *C. cf. griesbachi* (Bittner), and *C. decidens* (Bittner).

Among them *C. bioni* was previously reported as *C. stachei* (Nakazawa *et al.*, 1970). It occurs in association with many Permian-like brachiopods and bivalves, but was considered to be earliest Triassic in age partly because the species is confined to Griesbachian so far known. After detailed survey, the Kashmir species is revealed to differ from the Greenland form, and is now separated as a new species. The fossil-bearing beds are referred to the uppermost Permian. (Nakazawa *et al.*, 1975).

The Lower Triassic beds in Julfa called the Elikah Formation consist of thin- to thick-bedded limestones with a small amount of shale and marl intercalation. The lower part of the Lower Triassic group in Abadeh region was named as unit 8 by Taraz (1971), and later he divided the Lower Triassic into five units, a to e (Taraz, 1974). Unit 8 corresponds to unit a consisting mostly of thin-bedded limestones and marls. The lower part of the Elikah Formation and unit a are rich in *Claraia* throughout the formation, but very few in other fossils. Ammonoids are crowded at several horizons, but the preservation is not so good for specific identification: only referable to ophiceratid, *Gyronite*, and *Vishnuites*. The following species of *Claraia* are identified:

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CLASSIFICATION OF CLARAIA

The genus *Claraia* was proposed by Bittner (1901) as a sub-genus of *Pseudomonotis* together with *Eumorphotis* and *Eumicrotis*. At that time he included the following species in the subgenus:

Alpine species—*Pseudomonotis clarae* (Emmrich), *P. aurita* (Hauer), *P. aurita* var. *ovata* (Schauroth), *P. orbicularis* (Richthofen); and *P. intermedia* Bittner;

Himalayan species—*P. griesbachi* Bittner, *P. painkhandana* Bittner, and *P. decidens* Bittner.

Since then more than 40 species and subspecies or varieties have been recorded from various parts of the world. Ichikawa (1958) classified them into four groups mainly based on the characteristics of surface sculpture as follows:

- (1) Group of *Claraia clarai*—provided with strong, concentric folds or wrinkles, especially in adult stage; shell divisible into smooth umbonal part and sculptured remaining part. Example: *C. clarai*, *C. extrema*.
- (2) Group of *Claraia stachei*—developed in radial ribs; strong concentric sculpture undeveloped or lacking; umbonal part cannot be clearly distinguished from the rest in left valve. Example: *C. stachei*, *C. mulleri*, *C. intermedia*, *C. hunanica*, and *C. radialis*.
- (3) Group of *Claraia aurita*—provided with many, fine, raised concentric lines; concentric folds weak, irregular or incomplete, and small in number; radial ribs usually lacking or very weak. Example: *C. aurita*, *C. griesbachi*, *C. bittneri*, *C. subaurita*.
- (4) Group of *Claraia decidens*—isolated group with a small length/height ratio and strongly inflated

left valve; radial and concentric sculptures usually very weak or almost lacking. Example: *C. decidens*, *C. painkhandana*, *C. punjabiensis*, *C. australasiatica*.

Excepting the last one, these groups are not sharply defined from each other and cannot be treated as subgenera. Leonardi (1960) illustrated many transitional forms among them. The group of *decidens* is isolated as mentioned by Ichikawa in having strongly inflated left valve and tall outline with length/height ratio \leq unlike other groups. The right valve of this group is poorly known. Newly collected right valve of *decidens* (Pl. III—18) of Kashmir shows moderate convexity and deep byssal notch. *C. painkhandana* of South China (Hsu, 1937, p. 311, pl. 1, fig. 9) has also a narrow, deep byssal notch in the right as usual *Claraia*. It is noteworthy that the general shape of this group is very similar to "*Pseudomonotis*" *himaica* Bittner of the Central Himalayas and "*P.*" *occidentalis* Whiteaves (1889, p. 134, pl. 17, figs. 5, 6; Tojer, 1961, p. 98, pl. 28, figs. 7-12) of Canada except for radial ornaments of the latter two, suggesting some relationship between the two groups.

The groups of *clarai*, *stachei*, and *aurita* are conveniently subdivisible each into two subgroups by a grade of development of posterior auricle as in the followings.

(1) Group of *Claraia clarai*

- (1a) Posterior auricle more or less clearly defined
Sculptured with radial ribs: *clarai clarai* (Emmrich), *clarai elegans* Ichikawa, *clarai desquamata* Chen *et al.*, *occidentalis* Newell & Kummel, *catharinae* Leonardi

Radial ribs few and weak or absent: *tesidea* Leonardi, *dalpiazii* Leonardi.

(1b) Posterior auricle undeveloped

Provided with numerous radial ribs: *extrema extrema* Spath, *extrema ciriacksi*, n. subsp.

Radial ribs subdued or a few in number: *fukianensis* Chen *et al.*, *dieneri*, n. sp.

(2) Group of *Claraia stachei*

- (2a) Posterior auricle more or less clearly defined: *radialis* Leonardi, *radialis julfensis* n. subsp., *mulleri* Newell & Kummel, *intermedia* Bittner.

(2b) Posterior auricle undeveloped: *stachei* (Bittner) Spath, *bioni* n. sp.

(3) Group of *Claraia aurita*

- (3a) Posterior auricle more or less clearly defined
Provided with concentric sculpture only: *aurita aurita* (Hauer), *aurita flemmensis* Leonardi, *aurita haueri* Tommasi, *concentrica* Yabe, *orbicularis* Bittner, *subaurita* Krumbeck.

Provided with weak radial ribs in addition to concentric sculpture: *guizhouensis* Chen.

(3b) Posterior auricle undeveloped

Provided with concentric sculpture only: *wangi* Huang, *vietnamica* Vukhuc, *kiparisovae* Vukhuc.

Provided with weak radial ribs in addition to concentric ones: *griesbachi* (Bittner), *zhenanica* Chen & Liu, *bittneri* Ichikawa, *perthensis* Dickins & McTavish.

Claraia pulchella Nakazawa (1953, p. 264, pl. 3, figs. 1-7) of Japan and *C. hunanica* (Hsu) (In Huang and Hsu, 1938, p. 200, pl. 1, fig. 1) of South China may belong to the group of "Pseudomonotis" *himaica*.

Among the group of *C. clarai*, *C. clarai occidentalis* of the United States represented by right valves only was referred to as a synonym of *clarai* s. s. by Ciriacks (1963, p. 78), but it is retained as independent species until the left valve is examined as done by Ichikawa (1958). *C. clarai tesidea* (Leonardi, 1935, p. 59, pl. 3, fig. 2; 1960, pl. 6, figs. 3, 4, 6) is clearly distinguished from *clarai* in having acute concentric ridges and degenerated radial ribs, and is treated here as a distinct species. *C. radialis* originally placed under *clarai*, is characterized by development of relatively strong radial ribs and lacking in concentric folds of *clarai*-type. Therefore, the species is included in the group of *stachei* as a separate species (Ichikawa, 1958). *C. extrema* described by Ciriacks (*ibid.*, p. 79, pl. 15, figs. 5, 6) from the upper Lower Triassic Thaynes Formation of Nevada differs from the Griesbachian type-species of Greenland in developing concentric wrinkles on the umbonal part, more numerous concentric folds, reduced radial ribs, and more elongate shape. A new subspecies name, *ciriacksi*, is proposed here for this species.

Among the group of *C. stachei*, *C. stachei* was distinguished from *clarai* by Bittner (1901) based on the Alpine species, which is developed in radial ribs but lacking in concentric folds. Unfortunately, any figures were not given. Spath (1930) made a full description on the Greenland specimens. Spath's *stachei* has not a distinct posterior auricle. On the other hand, judged from Bittner's statement (1901, p. 587) and pointed out by Ichikawa (1966, p. 103), original specimens may have a clearly defined posterior auricle. Actually, no specimens identical with Greenland form have been reported from the Alps until now. Therefore, it seems certain that the Alpine species is distinct from Greenland species. Until Bittner's original specimens are examined, however, *C. stachei* is provisionally applied to Greenland form to avoid confusion.

STRATIGRAPHIC RANGE AND GEOGRAPHIC DISTRIBUTION OF *CLARAIA*

GEOGRAPHIC DISTRIBUTION

The genus *Claraia* has a worldwide distribution, but most species or subspecies are rather local, mainly concentrated in the South Alps and South China excepting several species, such as *C. clarai*, *C. aurita*, *C. stachei*, *C. intermedia*, etc.

Claraia clarai has been reported from various places in the world, but *clarai* s. s. seems to be limited to West Tethys, that is, the South Alps, Turkey, Iran, and Transcaucasus. *C. clarai* illustrated by Stepanov *et al.* (1969, pl. 15, figs. 1, 2) from Iranian Julfa is not *clarai* but referred to *extrema* Spath. However, the author collected *clarai* s. s. from the same region (Pl. I—1). *C. clarai* described by Hsu (1937, p. 307, pl. 1, figs. 1a, b) from China is an intermediate form between *C. radialis* and *C. intermedia* and similar to a transitional form of Leonardi (1960, pl. 7, fig. 5) in Venetia. Canadian species figured by Tozer (1961, p. 98, pl. 28, fig. 3) is ornamented with narrow, ridge-like concentric costae, relatively numerous for *clarai* s. s. and more similar to *clarai desquamata* Chen *et al.* (1974, p. 328, pl. 173, fig. 11) than to *clarai* s. s. *C. clarai* was reported from Nevada (Muller and Ferguson, 1939), but not illustrated. *C. clarai occidentalis* Newell & Kummel (1942, p. 955, pl. 3, figs. 1, 2) was distinguished from *clarai* in poorly developed sculptures but suppressed as a synonym of *clarai* by Ciriacks (1963, p. 78) because of poor preservation. Ichikawa (1958) excluded it from *clarai* for the time being.

Claraia aurita is a cosmopolitan species. It occurs in many places of the Alps, Transcaucasus, Iran, Pamir, China, North Viet-Nam, and southern Primorie, but is unknown in North America and Greenland. *C. aurita* described by Diener (1913, p. 42, pl. 5, fig. 9) from Pastun, Kashmir may not be *aurita* in having *clarai*-type concentric folds on the umbonal half of the shell.

Claraia concentrica Yabe distributed in Kashmir, China and Malaysia was originally referred to a subspecies of *griesbachi*, but is more allied to *aurita* in auriculate form and distinct concentric costae. It differs from *aurita* in less oblique and more circular shape. Part of *Claraia perthensis* Dickins & McTavish (1969, pl. 1, figs. 8, 9 non 2-7) of west Australia may not be conspecific with *perthensis* but probably belongs to *concentrica* in the well defined posterior auricle and absence of radial ornament.

Claraia stachei has been reported from the Alps, Iran, Transcaucasus, Kashmir, China, North Viet-Nam, Verchoyansk, Greenland, Canada, the United States and Australia. But that of the Alps, Iran, Kashmir, and presumably Transcaucasus is not identical with Green-

Table 1. Stratigraphic and geographic distribution of *Claraia*.

P: Permian, Ot: Otoceratan, Gy-F1: Gyronitan-Flemingitan, Ow: Owenitan, Co-Pr: Columbitan-Prohungaritan, Gl: Lower Griesbachian, Gu: Upper Griesbachian, Dn: Dienerian, Sm: Smithian, Sp: Spathian, 1: Alps, 2: Iran, 3: South of Middle Tethys (Salt Range, Kashmir, Central Himalayas), 4: East Tethys (China, Southeast Asia, Japan), 5: North America.

Australia and Timor are tentatively included in 3 and 4, respectively.

Species		P	Ot		Gy-F1	Ow	Co-Pr	Province					
			Gl	Gu	Dn	Sm	Sp	1	2	3	4	5	
Group of <i>Claraia claraia</i>	<i>claraia claraia</i>			●—————					○	○			?
	<i>claraia elegans</i>			—	—			○					
	<i>claraia desquamata</i>			—	—				○			○	○
	<i>occidentalis</i>			—	—								○
	<i>dalpiazii</i>			—	—			○	af				
	<i>catharinae</i>			—	—			○					
	<i>extrema extrema</i>			—	—				○				○
	<i>extrema ciriacksi</i>					—							○
	<i>fukianensis</i>			—	—							○	
	<i>dieneri</i>		—								○		
<i>C. stachei</i>	<i>radialis radialis</i>			—	—			○					
	<i>radialis julfensis</i>			—	—			○	○			?	
	<i>mulleri</i>			—	—								○
	<i>intermedia</i>			●—————				○	○			○	○
	<i>stachei</i>		—	●					af			○	○
	<i>bioni</i>		—								○		
Group of <i>Claraia aurita</i>	<i>aurita</i>			●—————					○	○		○	
	<i>concentrica</i>			●—————							○	○	
	<i>orbicularis</i>			—	—			○					
	<i>subaurita</i>					—						○	
	<i>flemmensis</i>			—	—			○					
	<i>guizhouensis</i>			—	—							○	
	<i>wangi</i>		—	—								○	○
	<i>vietnamica</i>			—	—							○	○
	<i>kipanisoavae</i>			—	—							○	○
	<i>griesbachi</i>		—	—							○	○	○
<i>bittneri</i>			—	—				○					
<i>zhenanica</i>			—	—								○	
<i>perthensis</i>			—	—							○		
<i>decidens</i>	<i>decidens</i>					—					○	af.	
	<i>painkhandana</i>		—								○	○	
	<i>punjabiensis</i>					—					○	○	
	<i>australasiatica</i>					—						○	

land form in the well-developed posterior auricle. *Claraia radialis julfensis* is newly proposed for Iranian and some Alpine species. That of Kashmir is emended to *C. bioni*, n. sp. as already remarked. Chinese *stachei* reported by Chen *et al.*, (1974, p. 328, pl. 173, figs. 4, 10, 14, 17) is transitional between *julfensis* and *stachei* in having long but very narrow posterior auricle. *C. stachei* described by Huang and Hsu (1938, p. 201, pl. 1, fig. 2) is compared to *julfensis* in having distinct and short posterior auricle. Australian species (Dickins & McTavish, *ibid.*, pl. 2, fig. 1) is a little different from Greenland form in obscure radial ribs near the shell margin, and similar to *Claraia dieneri*, n. sp. of Kashmir. Therefore, *C. stachei* is confined in distribution to North America, Greenland, China, and North Viet-Nam, and does not extend to West Tethys, although allied form (Pl. III—5-7) is found in the basal unit of the Elikah Formation in Julfa.

Claraia intermedia occurs from the Alps through Iran to Malaysia. Closely allied species, *C. guizhouensis* Chen (Patte, 1935, pl. 3, figs. 1, 4, 5 as aff. *griesbachi*; Liu, 1964, p. 323; Chen *et al.*, 1974, p. 327, pl. 173, fig. 1) is reported from South China.

Judged from the distribution of various species of *Claraia*, the Himalayan province including the Central Himalayas, the Salt Range, and Kashmir is related to East Tethys comprising South China and Southeast Asia (Malaysia, Indochina, Timor), sharing with several species, in common, that is, *C. concentrica*, *C. griesbachi*, *C. punjabiensis*, *C. painkhandana*, and *C. decidens*, notwithstanding the two provinces are considered to have been situated on the opposite side of the equator of the Tethyan sea during that time. On the other hand, Iranian province is closely connected with the Mediterranean province making one paleogeographic province, West Tethys.

In contrast to the prosperity of *Claraia* in the Tethys, Arctic province is very poor in diversity; only *C. stachei*, *C. clarai* s. l., and *C. extrema* are known so far.

STRATIGRAPHIC RANGE OF *Claraia*

Claraia is generally believed to be an important index fossil of the Lower Triassic. However, the discovery of undoubted *Claraia*, *C. bioni*, from the beds below the *Otoceras* zone in Kashmir in association with Permian brachiopods and bivalves, indicates the genus appeared in the Late Permian. Ichikawa (1958) considered that *Claraia* was derived from Aviculopectininae but allocated it with Pseudomonotinae. Newell and Boyd (1970) pointed out a close relation between *Claraia* and *Pseudomonotis* enumerating several morphological characters of *Claraia clarai*, common with type species of *Pseudomonotis*. The presence of cicatrix in *C. clarai* indicating the cemented habit was first remarked by Ichikawa (1958). Although a byssal notch of the right valve is retained

throughout the growth stage unlike the cemented pseudomonotids, such as *Pachypteria*, *Prospodylus*, and *Pegmavalvulina* (Newell and Boyd, *ibid.*), it offers another evidence of the intimate relationship. Furthermore, it should be mentioned that *Pseudomonotis permiana* Maslenikov described by Lutkevich and Lobanova (1960, p. 113, pl. 18, figs. 1-11) from the Kazanian in Siberia is externally very similar to *Claraia stachei* and *bioni* in general shape, sculpture, and small byssal auricle with narrow, deep sinus. *Claraia* may have originated from such forms of Pseudomonotidae in the Late Permian.

Claraia is rather rare in the Lower Griesbachian (*Otoceras woodwardi* zone) partly because of the limited distribution of the *Otoceras* beds in the world. In Kashmir, *C. bioni* is scarcely found from the basal part of the *Otoceras-Glyptophiceras* zone, and *C. dieneri* from near the top of this zone. *C. griesbachi* and *painkhandana* were originally described from the *Otoceras* Beds of the Central Himalayas by Bittner (1899).

Claraia sp. of the *Otoceras boreale* horizon in Greenland (Grasmück & Trümpy, 1969) may belong to the group of *stachei*. Hsu (1937) described the following species from the so-called *Otoceras* beds at various places in Kiangsu, Chekiang, Hupei, and Kwangsi, South China: *C. griesbachi*, *C. griesbachi* var. *concentrica*, *C. painkhandana*, *C. clarai*, and *C. wangi*.

Among these species, *C. clarai* is related to *intermedia* as already noticed, and the second species is referred to *griesbachi* s. s. in weak concentric sculpture with no distinct posterior auricle. They are not associated with ammonoids. Furthermore, *Otoceras* cf. *woodwardi* of the *Otoceras* beds is badly preserved, and accompanied with *Meekoceras hodgsoni* var. *involutum*, *Ophiceras* sp., and *Pseudosagoceras* sp., which are found in higher horizons of different ages than *Otoceras* in other regions. Therefore, further reexamination is required for their identification and the exact age of these *claraia*s is uncertain.

It is remarkable that the Permian and undoubtedly Lower Griesbachian species of *Claraia* are represented by those with undeveloped posterior auricle, whether they belong to the group of *stachei* or *aurita* or *clarai*. This fact suggests that auriculate forms were evolved from non-auriculate or obscurely auriculate forms in the Upper Griesbachian (*Ophiceras* zone). This is revealed from the detailed biostratigraphic study in Kashmir and Iran (Fig. 1). At Guryul ravine section, *C. bioni* (uppermost Permian—base of Triassic), *C. dieneri* (uppermost *Otoceras* zone), *C. cf. griesbachi* (uppermost *Otoceras* zone?) and *C. concentrica* (middle *Ophiceras* zone and later) occur successively in ascending order. Only the last species is auriculate. In Iran, *C. aff. stachei* (lower *Ophiceras* zone?), *C. radialis julfensis* (*Ophiceras* to *Gyronites* zones), *C. intermedia* and *aurita* (*Gyronites* zone) appear in this

order. The first species is obscurely auriculate. Similarly in China, according to Yin (1962), non-auriculate *C. wangi* characterizes the basal part (First member) of the Lower Triassic Tayeh Group, and auriculate forms, *C. aurita* and *C. clarai* constitute the representative molluscs of the lower part (Second and Third members).

In contrast to the scarcity of *Claraia* in the Lower Griesbachian, the genus was suddenly diversified in the Upper Griesbachian to Dienerian or Upper Otoceratan to Gyronitan. Most species of *Claraia* are concentrated in this time interval as shown in Table 1. There are many records of *Claraia* of the Werfen Formation in Europe, and it is known most *claraia*s occur in the lower Werfen (Seiser Schichten). Unfortunately, this part of the formation lacks ammonoids which enable us to determine the accurate stratigraphic position. A recent discovery of conodonts from the lower Werfen is, therefore, very important. According to Assereto *et al.* (1973) the Mazzin Member, that is, the lowermost member of the Werfen Formation in north Italy contains *Anchignathodus typicalis*, *Ellisonia* sp., and *A. isarcicus*. The first one is known from the Upper Permian to the lowermost Triassic in Julfa and Abadeh of Iran, the Salt Range, Kashmir, and Spiti (Sweet, 1973; Nakazawa, *et al.* 1975). The upper limit is in the *Ophiceras* zone. *A. isarcicus* is recorded from the Lower Kathwai Member in the Salt Range, and the lowermost part of the Elikah Formation Julfa. Abundant *claraia*s occur in the next Siusi Member, which contains *Ellisonia*. Assereto *et al.* (1973) correlated the Mazzin and Siusi Members with the Lower and Upper Griesbachian, respectively. Judged from the stratigraphic occurrence of *Claraia* and ammonoids in Iran and Transcaucasus (Rostovtsev and Azaryan, 1973; Nakazawa *et al.*, 1972), however, it cannot be concluded whether the Siusi fauna is Upper Griesbachian or Dienerian (Upper Otoceratan or Gyronitan of Spath) in age, but the predominance of auriculate forms of *Claraia* indicates the fauna does not go down to the Lower Griesbachian.

On the other hand, the isolated group of *decidens* is confined to the upper Lower Triassic excepting Otoceratan *C. painkhandana* of Spiti and South China. *C. decidens* is reported from the *Subrobustus* beds of Shalshal section (Bittner, 1899) and the *Meekoceras* beds of Guryul ravine (Diener, 1913; Nakazawa *et al.*, 1975,), both of which belong to Owenitan or Smithian. *C. aff. decidens* in Japan also came from the Owenitan *Xenoceltites aff. spitsbergensis* horizon (Bando, 1968). *C. punjabiensis* Wittenburg (1908) was described from *Stephanites superbus* zone of the Salt Range and the lower part of the Tungkaitsu Formation of China (Ku, 1948). The latter formation is correlated with the upper Lower Triassic, and the fossil-bearing beds are assigned to Owenitan. *C. gries-*

bachi described by Diener (1913, p. 41, pl. 5, fig. 8) from the "*Ophiceras*" Beds of Pastun, Kashmir may not be correctly identified as noticed by Tozer (1969, p. 354). It is more allied to *decidens* or *punjabiensis* than *griesbachi* in the strongly inflated left valve with prominent umbo. The "*Ophiceras*" Beds are now assigned to Owenitan (Smithian) in age (Tozer, 1969; Nakazawa *et al.*, 1975). *C. australasiatica* is of *Owenites* beds (Krumbeck, 1924).

It is interesting that the allied group of "*Pseudomonotis*" *himaica* with the exception of dubious species *hunanica* is also limited to the upper Lower Triassic like as *decidens* group.

SYSTEMATIC DESCRIPTION

- Family Pseudomonotidae Newell, 1938
Genus *Claraia* Bittner, 1901
Group of *Claraia clarai*
Claraia clarai (Emmrich)

Several subspecies or varieties have been distinguished in this species, that is, *ovata* Schaueroth, 1859, *radialis* and *tesidea* Leonardi, 1929, *circularis* Vialli, 1937, *occidentalis* Newell & Kummel, 1942, *elegans* Ichikawa, 1958, and *desquamata* Chen *et al.*, 1974. Ichikawa (*ibid.*) excluded *radialis*, *ovata*, *circularis*, and *occidentalis* from *clarai*. *Tesidea* is also referred to as a distinct species in this paper as already stated.

Claraia clarai clarai (Emmrich) (Plate I—1)

- 1844 *Posidonomya Clarae* Emmrich, S. 793.
1901 *Pseudomonotis (Claraia) clarai*, Bittner, S. 583, 585, Taf. 24, Fig. 14, 15.
1958 *Claraia clarai clarai*, Ichikawa, S. 141, Taf. 22, Fig. 1-5, (contains complete synonymy).
1960 *Claraia clarai clarai*, Leonardi, Tav. VI, Fig. 1, 3.
[non] 1963 *Claraia clarai*, Ciriacks, p. 78, pl. 16, fig. 7 (= *C. occidentalis* Newell & Kummel).
[non] 1969 *Claraia clarai*, Stepanov *et al.*, Pl. XV, figs. 1, 2 (= *Claraia extrema* Spath).

Remarks: The present species is rare in Iran; only a left valve has been obtained from a horizon 38 m above the base of the Elikah Formation (Gyronitan), Julfa.

Claraia clarai desquamata Chen, Ma, & Chang (Plate I—2)

- 1935 *Pseudomonotis* sp. aff. *P. clarai* et *P. griesbachi*, Patte, p. 6, Pl. III, fig. 13.
1957 *Claraia clarai*, Ku (in Ku *et al.*), p. 198, pl. 115, figs. 14, 15 (non 12, 13).
1974 *Claraia clarai desquamata* Chen, Ma, & Chang p. 328, pl. 173, fig. 11.
1961 *Claraia clarai*, Tozer, p. 98, pl. XXVIII, fig. 4.

Remarks: Illustrated right valve is 42 mm long and 36 mm high. Umbonal part about 13 mm high is slightly concave, ornamented with very weak radial and concentric costae. Concentric sculptures of remaining part become slender with growth and changes into lirae making scaly projection at the intersection of radial ribs.

The type specimen of *desquamata* is represented by a left valve. The umbonal half is similar to *clarai elegans* that has closely spaced concentric folds, but in mature stage they grow narrow and acute showing transitional character to *C. intermedia*. Such characteristic ornamentation is observed in *C. clarai* illustrated from the Spray River Formation in Alberta by Tozer (1961).

Occurrence: 36 m to 38 m above the base of the Elikah Formation, Julfa.

Claraia sp. aff. *C. clarai desquamata* Chen *et al.*
(Plate I—3)

Remarks: There are several specimens very similar to the preceding species in ornamentation, but they are distinguished in broadly spaced costae. In this respect, the present form is transitional with *C. tesidea*, which differs, however, in subdued radial ribs.

Occurrence: Same as *desquamata*.

Claraia sp. aff. *C. dalpiazzi* Leonardi
(Plate I—4, 5)

[cfr.] 1932 *Pseudomonotis dalpiazzi*, Leonardi, p. 33, figs. 7a, b.

[cfr.] 1935 *Claraia dalpiazzi*, Leonardi, p. 58, Tav. IV, figs. 4, 5.

[cfr.] 1960 *Claraia dalpiazzi*, Leonardi, Tav. V, fig. 5.

Remarks: Only left valves are at hand. Shell is fairly convex and sculptured with concentric folds of *clarai*-type and 3 to 7, widely spaced, very weak radial ribs. Concentric folds are variable in strength, but usually fairly strong. The present species is somewhat similar to *C. tesidea* in poor development of radial ribs, but concentric folds are rounded unlike *tesidea*. It seems more intimate to *C. dalpiazzi* but distinguishable in having radial ornament. All the specimens are incomplete, and the auricles could not be detected.

Occurrence: Common in the lower part of the Elikah Formation, Julfa, and unit 8 (Taraz, 1971) or unit a (Taraz, 1974) of the Lower Triassic in Abadeh.

Claraia extrema extrema Spath
(Plate I—6-8)

1935 *Pseudomonotis (Claraia) extrema* Spath, p. 21 pl. 20, fig. 10; pl. 21, fig. 2.

1969 *Pseudomonotis (Claraia) clarai*, Stepanov *et al.*, pl. 15, Figs. 1, 2.

[non] 1963 *Claraia extrema*, Ciriacks, p. 79, pl. 15, figs. 5, 6
(=*Claraia extrema ciriacksi*, n. subsp.).

Remarks: *Claraia extrema* is intimately related to *C. clarai*, but differs in coarser and less numerous concentric folds and undeveloped posterior auricle. Concentric folds are counted 4 on the left valve and 5 or more in the right of Greenland forms. The Julfan species is quite identical with the type in all specific characters. *Claraia clarai* illustrated by Stepanov *et al.* (1969) from the Elikah Formation undoubtedly belongs to the same species as our collection.

Measurements:

No.	L (in mm)	H	L/H	n*
1 (R)	55	52	1.05	5
2 (R)	48	40	1.20	5
3 (R)	44	49	0.90	4
4 (R)	ca 39	36	1.08	5
6 (L)	37	34	1.09	3
8 (L)	ca 45	43	1.05	4

R : right valve, L: left valve.

*Number of concentric folds.

Occurrence: Common in the lower part of the Elikah Formation, Julfa, and rare in the lowermost part of unit a of the Lower Triassic in Abadeh.

Claraia sp. aff. *C. extrema* Spath
(Plate I—10)

Remarks: The species is represented by a single, deformed, left valve, which is 30 mm long, 25 mm high, and ovate in shape. Anterior auricle is very small, obtusely triangular; posterior one obscurely defined, slightly depressed, devoid of concentric folds. Surface is covered with 5 concentric folds and very weak, close-set concentric costae. Several thread-like radial and ornaments are observed in the median part of shell.

The present species belongs to the group of *C. clarai*, but differs from type species in poor development of radial ribs and obscure posterior auricle. It is more allied to *C. extrema*, but is distinguished in less numerous and obsolete radial ribs.

Occurrence: Bed 62a of the Khunamuh Formation at Guryul ravine, Kashmir (base of the *Ophiceras* zone).

Claraia dieneri Nakazawa, sp. nov.
(Plate I—9; Plate II—1-3)

1963 *Claraia stachei*, Dickins & McTavish, p. 132, pl. 2, fig. 1.

Description: Shell large, subcircular, inequivalve with convex left and flat right valves; length nearly equal to, or slightly larger, than height; umbo not prominent, with

orthogyrate beak lying at about anterior one-third of shell length; hinge line short attaining about a half of shell length; posterior auricle not differentiated from main body; right anterior auricle very small provided with deep byssal notch and distal side almost fused with shell margin; surface sculptured with concentric folds and radial ribs, of which the former are developed mainly on the umbonal part and the latter limited in the medial part.

Remarks: Both concentric and radial sculptures are rather variable and become obsolete in mature stage. Concentric folds are generally more developed in the right valve, while the radial ribs are more developed in the left valve. The present species is similar to *C. clarai* in early stage, but easily distinguished in adult stage by its obsolete ornaments and undeveloped posterior auricle. Australian *C. perthensis* Dickins & McTavish (1963, p. 131, pl. 1, figs. 2-7; non 8, 9) is another similar species in size and outline, but differs in weaker radial sculpture and lack of concentric folds. *C. stachei* described by the same authors (*ibid.*, p. 132, pl. 2, fig. 1) is almost identical with this species in shape and characteristics of ornaments. Concentric folds cannot be seen in the Australian form, but they are not developed in some of Kashmir specimens too.

Measurement:

No.	L	H	L/H	U*	U/L
1 (R)	50	46	1.10	19	0.36
2 (R)	43	45	0.95	19	0.33
3 (R)	ca 48	43	1.10	19	0.32
4 (L)	ca 47	42	1.10	19	0.32
5 (L)	ca 42	36	1.20	ca 12	0.29

*Distance between beak and anterior margin.

R Right valve and L Left valve.

Occurrence: Common in Bed 59a of the Khuamuh Formation at Guryul ravine, Kashmir (top of the *Otoceras-Glyptophiceras* zone), and *Ophiceras* zone of Perth Basin, Australia.

Holotype: G. S. I. Type No. 19004.

2. Group of *Claraia stachei*

Claraia radialis julfensis Nakazawa, subsp. nov.
(Plate II—4-8)

- 1960 Transitional form between *Claraia clarai radialis* and *Claraia intermedia*, Leonardi, Tav. VII, fig. 2.
1969 *Claraia stachei*, Stepanov et al., Pl. XV, figs. 3a—e, 6.
1938 *Pseudomonotis* sp. ind. aff. *P. stachei*, Huang and Hsu, p. 202, pl. I, fig. 2.

Description: Shell moderate in size, inequilateral, a little extended posteroventrally, inequivalve with convex left and flat or slightly concave right valves; longer than high; ornamented with 40 to 65, uniform radial ribs and weak growth lines; umbo beaked, orthogyrate, lying at about anterior one-third of shell length; umbonal part 5 to 10 mm high nearly smooth; posterior auricle short, subtrigonal, depressed, clearly differentiated; right anterior auricle very small, subrectangular, provided with deep, hollow-like byssal notch.

Remarks: The radial ribs of left valve consist of about 20 primary and 20 to 40 secondary ones, both having nearly equal strength; those of right valve are weaker than those of left and not differentiated. The present species looks very like *Claraia stachei* of Greenland in ornamentation and general shape, but differs in having clearly defined posterior auricle. It is most allied to *C. radialis* Leonardi described from the Siusi Member in northern Italy, which was originally proposed as a subspecies of *clarai* but is more similar to *stachei* in strong radial ribs and lack of concentric folds. Unfortunately, ever described *radialis* is not so well preserved, but judged from the illustrations the present form can be distinguished from *radialis* and its allies in the development of more distinct radial ribs and weaker concentric sculpture. One of specimens referred to transitional form between *radialis* and *intermedia* by Leonardi (1960) is identical with this species. *Claraia* aff. *stachei* in China (Huang and Hsu, 1938) is most probably conspecific but material is insufficient for precise identification.

Measurement:

No.	L	H	L/H	U	U/L	n*
1 (L)	39	37	1.05	13	0.33	42
2 (L)	37	35	1.06	13	0.36	48
4 (L)	39	36	1.08	14	0.36	51
6 (R)	44	39	1.12	18	0.40	41
9 (L)	44	39	1.12	15	0.33	58
12 (L)	46	39	1.16	15	0.33	65
13 (R)	36	33	1.07	14	0.39	46+
14 (L)	35	36	0.97	12	0.33	50
15 (L)	42	40	1.05	19	0.38	65

R-Right valve, L-Left valve.

*Number of radial ribs.

Occurrence: Abundant throughout the lower part of the Elikah Formation in Julfa, and unit a in Abadeh, Siusi Member of Werfen Formation in north Italy, and

Hunan? of South China, Upper Griesbachian to Dienerian
(Upper Otoceratan to Gyronitan).

Claraia intermedia Bittner
(Plate II—9-11)

- 1850 *Posidonomya aurita* Hauer (part), S. 12, Taf. 3, Fig. 6 (non 5, 7) and indeterminate species (Taf. 3, Fig. 9).
1901 *Pseudomonotis (Claraia) intermedia* (incl. var. *cancellata*), Bittner, S. 585, Taf. XXIV, Fig. 13.
1908 *Pseudomonotis intermedia*, Wittenburg, S. 26, Taf. 3, Fig. 3-6.
1927 *Pseudomonotis intermedia*, O-Gordon, S. 19, Taf. 1, Fig. 3.
1935 *Claraia intermedia*, Leonardi, S. 60, Taf. 3, Fig. 5-8.
1960 *Claraia intermedia* (incl. transitional forms to *radialis*), Leonardi, Tav. VI, Fig. 5, 10, 11; Tav. VII, Fig. 1, 3, 5; Tav. VIII, Fig. 1.
1966 *Claraia intermedia multistriata* Ichikawa, p. 102, Pl. II, Figs. 1-5.
1968 *Claraia intermedia multistriata*, Tamura, p. 81, pl. XI, figs. 15-17.

Remarks: *C. intermedia* is characterized by lattice ornament made of concentric sculpture of *aurita*-type and radial ribs of *stachei*-type. Two varietal forms have been discriminated in the species, that is, *cancellata* Bittner and *multistriata* Ichikawa. However, both radial and concentric ornaments are highly variable in strength and number as well, and there seems to be many intergrading forms as observable in the collection from Iran. Future examination is required to split these varietal forms as subspecies. Transitional form to *radialis* by Leonardi is included in this species.

Occurrence: Common in the upper part of the Lower Elikah Formation, Julfa, and the lower part of unit a, Abadeh region.

Claraia sp. aff. *C. stachei* (Bittner) Spath
(Plate III—5-7)

Description: Shell small, usually less than 20 mm long and 31 mm at largest, length nearly equal to, or slightly larger, than height; left valve moderately inflated, right one flat or a little convex; posterior auricle not clearly defined from main body; umbo not prominent, lying at about anterior one-third to two-fifths of shell length; surface sculptured with 10 to 20, weak radial ribs and growth lines; right valve provided with deep and narrow byssal notch.

Remarks: The present species is very similar to *Claraia stachei* especially its varietal form, *kilensis* that has less numerous radial ribs, but the sculpture of the Iranian species is much weaker, and the shell is smaller. Exact comparison is difficult due to bad preservation of the materials at hand.

Measurement

No.	L	H	L/H	U	U/L	n
2 (L)	28	27	1.04	9	0.32	11
3 (R)	17	16	1.06	5.5	0.32	?
6 (L)	20	20	1.00	9	0.45	12
7 (L)	20	18.5	1.08	8.5	0.43	10
8 (L)	13.5	14.5	0.93	5	0.37	11
1 (R)	31	11.5	0.37	20

R-Right valve, L-Left valve.

Occurrence: Common in basal unit of the Elikah Formation, Julfa.

Claraia bioni Nakazawa, sp. nov.
(Plate II—12; Plate III—1-4)

1970 *Claraia stachei*, Nakazawa *et al.*, p. 168, Pl. 29, Figs. 4, 5.

Description: Shell medium to small, ovate, somewhat extended posteroventrally, inequilateral, inequivalve with gently inflated left and nearly flat right valves; a little longer than high; hinge line relatively short; umbo subdued, a little salient above hinge margin in left valve; left anterior auricle very small, depressed and triangular; right anterior one subquadrangular with hollow-like byssal opening; posterior auricle gradually flattened from main body and not differentiated; surface sculptured with numerous radial ribs and dense, concentric growth lines, of which radials being somewhat irregular in strength and usually differentiated into two ranks and varying in number from 30 to more than 50.

Remarks: This species is undoubtedly closely allied to *Claraia stachei* of Greenland, China, and North Vietnam, and previously identified with that species, but it is distinguished in less inflated left valve with less prominent umbo and minutely waved radial ribs, especially in mature stage. *Pseudomonotis permiana* Maslenikov described from the Kazanian of Siberia by Lutkevich and Lobanova (1960, p. 113, pl. 18, figs. 1-11) is similar to this species, but differs in coarser radial ribs, more oblique shape, and more inflated right valve. All the materials have been deformed secondarily as shown in the measurement.

Measurement:

No.	L	H	L/H	U	U/L	n
1 (L)	28	22.5	1.03	11	0.39	45+
2 (L)	26.5	23.5	1.10	9	0.34	52
3 (L)	26	22	1.20	10	0.38	50
4 (L)	22	22	1.00	9	0.41	42
5 (R)	26	21	1.40	10	0.38	40
6 (L)	26.5	22.5	1.20	11	0.42	28

R-Right valve, L-Left valve.

Occurrence: Common in the basal unit of the Khunamuh Formation, and scarce in the base of the *Otoceras* beds (latest Permian to earliest Triassic), Kashmir.

Holotype: G. S. I. Type No. 19005.

Claraia sp. nov. indet.
(Plate III—8)

Remarks: This small *Claraia* of subcircular shape is characteristic in broadly spaced concentric ridges and relatively small number of radial ribs developed in the medial part of the shell. It is similar to *Claraia fukianensis* Chen, Ma, & Chang (1974, p. 327, pl. 173, figs. 8, 9) of China belonging to the *clarai* group, but the concentric costae are weaker and more regularly disposed, and radials are more closely set. This species probably represents a new form of *Claraia*, but the materials are poor to give specific characters.

3. Group of *Claraia aurita*
Claraia aurita (Hauer)
(Plate III—12)

- 1850 *Posidonomya aurita* Hauer, S. 12, Taf. 3, Fig. 5, 7 (non 6).
1901 *Pseudomonotis (Claraia) aurita*, Bittner, S. 587, Taf. 24, Fig. 10.
1907 *Pseudomonotis (Claraia) aurita*, Frech, S. 19, Taf. 6 Fig. 1a-c, 4?
1908 *Pseudomonotis aurita*, Wittenburg, S. 25, Taf. 1, Fig. 1; Taf. 2, Fig. 13, 14.
1927 *Pseudomonotis (Claraia) aurita*, O.-Gordon, S. 18, Taf. 1, Fig. 2.
1935 *Claraia aurita*, Leonardi, p. 63, Tav. III, Fig. 12 15.
1938 *Pseudomonotis (Claraia) aurita*, Kiparisova, p. 229, pl. 3, figs. 5-7.
1950 *Pseudomonotis (Claraia) aurita*, Chen, p. 88, pl. 1, figs. 7a-c, 8.
1960 *Claraia aurita*, Leonardi, Tav. VIII, Fig. 7, 9.
1969 *Claraia aurita* Stepanov *et al.*, Pl. XV, fig. 4.
[non] 1913 *Pseudomonotis (Claraia) aurita*, Diener, p. 42, pl. 5, fig. 9.
[non] 1974 *Claraia aurita*, Chen *et al.*, p. 328, pl. 174, figs. 17, 18, 21, 24.

Remarks: Several subspecies or varieties have been distinguished in *aurita* based on the difference of obliquity, length/height ratio, and strength of sculpture, that is, *haueri* Tommasi, *ovata* Schaubroth, and *costulata* Leonardi. In cases the distinction of these forms is difficult, especially when the specimens are secondarily deformed. The concentric sculpture is also variable to considerable degree, from very dense to loosely spaced. Posterior auricle is usually well defined, but in some cases obscure.

Occurrence: Common in the upper part of the Lower Elikah Formation, Julfa, and the lower part of unit a in Abadeh.

Claraia concentrica Yabe
(Plate III—9-11)

- 1908 *Pseudomonotis (Aviculopecten) griesbachi*, Mansuy, p. 62, pl. 16, figs. 4, 5
1924 *Pseudomonotis (Claraia) griesbachi* var. *concentrica* Yabe, p. 310, pl. 1, figs. 4, 4a.
1935 *Pseudomonotis* sp. aff. *griesbachi*, Patte, p. 24, Pl. II, figs. 18, 19; Pl. III, fig. 6 (non 1-5).
1950 *Pseudomonotis (Claraia) griesbachi concentrica*, Chen, p. 89, pl. 1, fig. 9.
1968 *Claraia griesbachi concentrica*, Tamura, p. 78, pl. 11, figs. 1-14.
1974 *Claraia concentrica*, Chen *et al.*, p. 328, pl. 173, figs. 12, 13.
1974 *Claraia aurita*, Chen *et al.*, p. 328, pl. 174, figs. 17, 18, 21, 24.

Remarks: The present form was distinguished from *griesbachi* as its subspecies in taller shape and distinct concentric sculpture. It is more intimate to *C. aurita*, only differing in less oblique outline, and may be suppressed to a subspecies of the latter. This should be examined together with other subspecies of *aurita*. The concentric sculpture is variable in strength and spacing as in *aurita*.

Occurrence: Common in the middle to upper part of the *Ophiceras* zone in Kashmir.

Claraia sp. cf. *C. griesbachi* (Bittner)
(Plate III—13, 14)

- [cfr.] 1899 *Pseudomonotis griesbachi* Bittner, p. 2, pl. 1, figs. 1-4.
[cfr.] 1907 *Pseudomonotis griesbachi*, Frech, S. 21, Taf. 6, Fig. 5.
[cfr.] 1937 *Pseudomonotis (Claraia) griesbachi*, Hsu, p. 308, pl. 1, figs. 2-4.
[non] 1913 *Pseudomonotis (Claraia) griesbachi*, Diener, p. 41, pl. 5, fig. 8.

Remarks: All the specimens at hand are secondarily deformed to considerable degree, but the general shape, weak concentric sculpture, and presence of thread-like radial costae in some specimens indicate the comparison with *griesbachi* is reasonable.

Occurrence: Rare in the top of the *Otoceras* Zone at Guryul ravine, and common in the *Otoceras* zone 3 km north of Barus.

4. Group of *Claraia decidens*
Claraia decidens (Bittner)
(Plate III—15-19)

- 1899 *Pseudomonotis decidens* Bittner, p. 11, Pl. 1, figs. 22-24.
1913 *Pseudomonotis (Claraia) decidens*, Diener, p. 43, Pl. V, Figs 14a-c.

Description: Shell small to fairly large, strongly inequivalve, ovate in shape; left valve strongly convex with prominent umbo; beak orthogyrate, lying between anterior

one-third and middle of shell; hinge line short; anterior ear very small, depressed, not sharply defined from main body; posterior ear undeveloped; surface nearly smooth, covered with weak, close-set growth lines; right valve gently convex, anterior ear deeply notched; posterior ear obscure.

Remarks: There are many specimens crowded in the limestone of Bed 88 at Guryul ravine. The shape of shell is considerably variable, some being narrow and oblique in outline and others broad and nearly symmetric, but all these forms are connected by intermediate forms and cannot be separated as distinct species. The oblique form is similar to *painkhandana* of the *Otoceras* beds of the Central Himalayas, and on the other hand symmetric form is very like *punjabiensis* of the Salt Range or *australasitica* of Timor. Majority of the specimens have L/H ratio=1.0-0.9, and broader than *painkhandana*, of which ratio is about 0.86. Irregularity in the beak noticed by Bittner is observed in the present specimens. *C. painkhandana* described by Diener (1913, p. 43, Pl. V, fig. 10) from Pastun is most probably an aberrant form of *decidens*. It is possible that *Pseudomonotis (Claraia) griesbachi* from the same limestone of Pastun (Diener, *ibid.*, p. 41, Pl. V, figs. 8a-c) is also referred to the present species judged from the variability of this species.

Measurement:

No.	L	H	L/H	U	U/L	D*
1 (L)	25	25.5	0.99	11	0.44	10.5
2 (L)	21	23	0.91	8	0.38	8
3 (L)	18	17.5	1.02	8	0.44	8
4 (L)	23	26	0.88	7.5	0.33	8.5
5 (L)	13	13	1.00	6	0.46	5.5
6 (L)	5.5	6.0	0.91	2	0.35	2.3
7 (L)	8.2	8.5	0.95	3.8	0.46	3

L-Left valve.

Occurrence: Abundant in Bed 88 (*Meekoceras* beds) at Guryul ravine, common in the "*Ophiceras*" beds at Pastun (Owenitan or Smithian).

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EXPLANATION OF PLATES

PLATE I

1. *Claraia clarai clarai* (Emmerich), left gypsum mold, Elikah Formation, Julfa.
 2. *Claraia clarai desquamata* Chen *et al.*, Elikah Formation, Julfa.
 3. *Claraia* sp. aff. *C. clarai desquamata* Chen *et al.*, Elikah Formation, Julfa.
 - 4, 5. *Claraia* sp. aff. *C. dalpiazii* Leonardi, lower part of Elikah Formation, Julfa.
 - 6-8. *Claraia extrema extrema* Spath, 6: right external cast, 7: left gypsum mold, 8: left external mold, lower part of Elikah Formation, Julfa.
 9. *Claraia dieneri* Nakazawa, n. sp., external cast of left (l) and right (r) valves, Unit E₂ of Khunamuh Formation, Guryul ravine, Kashmir, right valve in the middle: holotype (G. S. I. Type No. 19004).
 10. *Claraia* sp. aff. *C. extrema* Spath, left gypsum mold, Unit E₂ of Khunamuh Formation, Guryul ravine. ×1.5.
- (All in natural size excepting Fig. 10.)

PLATE II

- 1-3. *Claraia dieneri* Nakazawa, n. sp., 1: right external cast, 2: left gypsum mold, 3: left external cast, Unit E₂ of Khunamuh Formation, Guryul ravine.
- 4-8. *Claraia radialis julfensis* Nakazawa, n. subsp., 4-6: left external mold, 7: right external cast, 8: right external mold, Elikah Formation, Julfa.
- 9-11. *Claraia intermedia* Bittner, 9: right external cast, 10 and 11: left external molds, Elikah Formation, Julfa.
12. *Claraia bioni* Nakazawa, n. sp., left external molds, Unit E₁ of Khunamuh Formation, Guryul ravine, a: holotype, (G. S. I. Type No. 19005), b: paratype.

(All in natural size.)

PLATE III

- 1-4. *Claraia bioni* Nakazawa, n. sp., 1 and 3: right external casts, 2: left external mold, 4: left gypsum mold. 2-4, $\times 1.5$, Unit E₁ of Khunamuh Formation, Guryul ravine.
- 5-7. *Claraia* sp. aff. *C. stachei* (Bittne) Spath, 5: right external cast, 6 and 7: left external molds, basal part of Elikah Formation, Julfa.
8. *Claraia* n. sp. indet., left external mold, Unit E₂ of Khunamuh Formation, Guryul ravine.
- 9-11. *Claraia concentrica* Yabe, 9: right external cast, 10: distorted, left gypsum mold, 11: left external mold, Unit E₃ of Khunamuh Formation, Guryul ravine (11) and lower part of Khunamuh, Pahlgam (9) and Pastun (10).
12. *Claraia aurita* (Hauer), left external mold Elikah Formation, Julfa.
- 13-14. *Claraia* sp. cf. *C. griesbachi* (Bittner), left gypsum molds, Unit E₃ of Khunamuh Formation, Guryul ravine, $\times 1.5$.
- 15-19. *Claraia decidens* (Bittner), 15-17: left external molds, 16a: anterior view, 17a: dorsal view, 18: right external mold, 19: immature left valve showing aberrant umbo, 15, $\times 1.5$, Member H (*Owenites* zone) of Khunamuh Formation, Guryul ravine.
- (All in natural size, unless otherwise indicated.)





