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COMPARATIVE DIAGNOSES OF CONIDÆ AND CANCEL-
LARIIDÆ FROM THE TERTIARY FORMATIONS OF BURMA.
BY E. VREDENBURG, *Superintendent, Geological
Survey of India.* (With Plate 15.)

THE present note, containing a list of the Conidæ and Cancel-
lariidæ so far known from the Tertiary formations of Burma,
with preliminary comparative diagnoses of the forms regarded as new,
constitutes a continuation of similar notices already published in
these Records on the Terebridæ (Vol. LI, p. 339) and Pleuroto-midæ
(see p. 83) and completes the preliminary account of the group
of the Toxoglossa amongst the siphonostomatous gastropods.

The specimens dealt with in the present note range in geological
age from Eocene to Burdigalian. As was already done with refer-
ence to the families previously considered, a list is subjoined
enumerating the localities from which the specimens were obtained,
together with their geographical bearings.

	Lat.		Long.	
	°	'	°	'
1. Dalabe	19	37	95	18
2. Kama	19	1	95	9
3. Kyaukkwet Chaung	21	40	94	14
4. Kyaungon	19	30	95	23
5. Kyudawon (a hamlet near Tittabwe)				
6. Minbu	20	10	94	55
7. Migyaungye	19	54	95	9
8. Mindegyi	19	48	94	53
9. Myaukmigon	19	31	95	24
10. Myauktin	19	28	95	22
11. Myodaung	18	18	95	2

No. 3. CONIDÆ AND CANCELLARIIDÆ.

Rec. Geol. Surv. Ind., Vol. LIII, pp. 130-141.

Page 130.—In the list of localities, *between* numbers 5 and 6
insert 'Kyundaw, 19° 52', 95° 11'.' The fossiliferous
horizon of this locality belongs approximately to the
Singu stage (upper oligocene).

The same stage, or upper Eocene age, is represented by the
following localities: 3 Kyaukkwet Chaung, 19 Thetkegyin.

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ference to the families previously considered, a list is subjoined
enumerating the localities from which the specimens were obtained,
together with their geographical bearings.

	Lat.	Long.
1. Dalabe L. Mioc.	19 37	95 18
2. Kama L. Mioc.	19 1	95 9
3. Kyaukkwet Chaung U. Eoc.	21 40	94 14
4. Kyaungon L. Mioc.	19 30	95 23
5. Kyudawon (a hamlet near Tittabwe) L. Mioc.		
6. Minbu M-U. Oligoc.	20 10	94 55
7. Migyaungye U. Oligoc.	19 54	95 9
8. Mindegyi M-U. Oligoc.	19 48	94 53
9. Myaukmigon L. Mioc.	19 31	95 24
10. Myauktin L. Mioc.	19 28	95 22
11. Myodaung U. Oligoc.	18 16	95 4
12. Nyaungbintha M-U. Oligoc.	19 35	95 14
13. Payagyigon M-U. Oligoc.	20 43	95 4
14. Prome U. Oligoc. - L. Mioc.	18 42	95 16
15. Singu U. Oligoc.	20 56	94 51
16. Sitsaba L. Mioc.	19 4	95 16
17. Thanga L. Mioc.	19 32	95 23
18. Thayetmyo U. Oligoc.	19 19	95 13
19. Thetkegyin U. Eoc.	21 17	94 18
20. Tittabwe L. Mioc.	19 31	95 28
21. Yenangyat M-U. Oligoc.	21 6	94 48

The Yaw stage, of Upper Eocene age, is represented by the
following localities: 3 Kyaukkwet Chaung, 19 Thetkegyin.

To the Sitsayan stage, of Stampian age, belong : 6 Minbu, 8 Mindegyi, 13 Payagyigon, 21 Yenangyat. The locality Nyaungbintha, No. 12, belongs either to the Sitsayan stage, or to the base of the overlying Singu stage.

The Singu stage, regarded as Chattian, is represented by 7 Migyaungye, 11 Myodaung, 15 Singu, 18 Thayetmyo.

The locality No. 14 represents the zone of *Cytherea promensis* opposite Prome, which may be regarded as a passage bed between the Singu and Kama stages.

The Kama stage, Aquitanian, includes : 1 Dalabe, 2 Kama, 4 Kyaungon, 5 Kyudawon, 9 Myaukmigon, 10 Myauktin, 17 Thanga, 20 Tittabwe.

The Pyalo stage, Burdigalian, is represented by the locality No. 16 Sitsaba.

Family : CONIDÆ.

Genus : GENOTIA H. and A. Adams 1853.

The following species of *Genotia* are known from the Tertiary formations of India :

1. *Genotia aspera* [Edwards] (= *Pleurotoma dictyophora* C. and P., *Pal. Ind.*, new ser., Vol. III, Mem. 1, p. 11, Pl. IV, figs. 29, 30). Upper Cuisian (Upper Ranikot, zone 4), Sind.
2. „ *iravadica* Noetling.
3. „ *Garrowi*.
4. „ *birmanica*.
5. „ *singuënsis*.

GENOTIA IRAVADICA Noetling.

Pl. XV, fig. 3.

1895. *Pleurotoma (Cryptoconus) iravadicus* Noetling. *Mem. Geol. Surv. Ind.*, Vol. XXVII, part 1, p. 41, Pl. IX, fig. 6.

1901. *Genotia iravadica* Noetling.—*Pal. Ind.*, new ser., Vol. I, part 3, p. 347, Pl. XXII, figs. 25, 26.

The most characteristic feature of this shell is its extreme elongation, by which it is readily distinguished from certain forms otherwise closely related, such as *Genotia pseudocolon* [Giebel] from the Oligocene of Lattorf, and especially *Genotia Craverii* Bellardi from the Tortonian of Piedmont.

Occurrence.—Minbu ; Mindegyi (relatively high horizon) ; Singu, C/D.

exhibited by the shells of either of the above-mentioned genera ; but, while there do not appear to be any known examples of such a disposition in *Bathytoma*, this peculiarity is observed to a varying extent amongst some of the Eocene species of *Genotia*, particularly in *Genotia aspera* [Edwards] of the Barton beds of the Hampshire basin and Lower Eocene of Sind, which is readily distinguished by its more ventricose shape and by its coarser and wider-spaced spiral threads.

Occurrence.—Singu “ H.”

Genus : CRYPTOCONUS von Koenen 1867.

Only one¹ species of this genus has hitherto been observed in the Tertiary formations of India :

Cryptoconus perliratus Cossmann and Pissarro (*Pal. Ind.*, new ser., 1909, Vol. III, part 1, p. 18, Pl. I, fig. 24, Pl. VII, figs. 47, 48). Upper Cuisian (Upper Ranikot, zone 4) of Sind.

The genus has not been observed amongst the fossil fauna of Burma.

Genus : CONORBIS Swainson 1840.

The following forms of *Conorbis* are known from the Tertiary formations of India :

Conorbis dormitor Sol., var. *sindiensis* Vred. Nari of Sind.

” ” ” , var. *bhagothorensis* Vred. Nari of Sind.

The genus has not been observed in the Tertiary fauna of Burma.

Genus : CONUS Linnæus 1758.

A study of the numerous forms of *Conus* which occur in the Indian Tertiary, clearly reveals the want of sharpness between the various subdivisions of this genus, which all grade into one another so completely that they can only be regarded at most as sections. They never seem sufficiently sharply contrasted to rank as subgenera. For instance, *Conospira* may be regarded merely as a *Stephanoconus* with an elongated spire ; *Leptoconus* as a *Conospira* with feeble crenulations ; *Lithoconus* as a *Leptoconus* with a low spire ;

¹ *Cryptoconus surculaformis* C. and P. (*Pal. Ind.*, new ser., Vol. II, Mem. 1, p. 17, Pl. II, figs. 6, 7), from zone 1 of the Upper Ranikot of Sind, is founded on an incomplete specimen of *Calyptrophorus indicus* C. and P.

Dendroconus as a *Lithoconus* with rounded shoulder; *Chelyconus* as a *Dendroconus* with tall spire, or else as a *Leptoconus* with convex spire-whorls. In many cases, much hesitation is felt in deciding which one of two divisions is more appropriate for classifying a particular shell, sometimes even, which one of three divisions; which clearly indicates the great homogeneity of this vast genus, and the inexpediency of partitioning it into divisions of the rank of subgenera.

The following forms of *Conus* are known from the Tertiary of India :

Group of *Conus cedonulli* Klein.

1. *Conus* (*Stephanoconus*) *cedonensis* Martin. Myaukmigon, Tittabwe.

Group of *Conus antediluvianus* Bruguière.

2. *Conus* (~~*Conospira galensis* Noetling.~~ *Mindegyi* (relatively high horizon); Singu "F"; Yenangyat.

Group of *Conus aculeiformis* Reeve.

3. *Conus* (*Leptoconus*) *protofurvus* Noetling (*Pal. Ind.*, new ser., Vol. I, part 3, Pl. XXIII, fig. 25; non fig. 26 = *Conus vimineus* Reeve). Minbu; Mindegyi (relatively low horizon); Singu "F"; Yenangyat.
4. „ (*Leptoconus*) *vimineus* Reeve (= *C. palubuanensis* Martin, *Summl. des geol. Reichs-Mus. in Leiden*, new ser., Vol. I, p. 16, Pl. II, fig. 26; = *C. subvimineus* Cossmann, *Journ. Conch.*, Vol. XLVIII, p. 64, Pl. IV, figs. 47, 48; = *C. profurvus* Noetling (*pars*), *Pal. Ind.*, new ser., Vol. I, part 3, Pl. XXIII, fig. 26, non fig. 25). Dalaba, Kama, Kyaungon, Myauktin, Thanga, Tittabwe; also in the Tertiary beds of Karikal; also in the Mekran beds of Baluchistan.
5. „ (*Leptoconus*) *cosmetulus* Cossmann (*Journ. Conch.*, 1900, Vol. XLVIII, p. 63, Pl. IV, figs. 11, 12, =? *C. vimineus* var.) Upper Tertiary of Karikal.

Group of *Conus planiliratus* Sowerby.

6. *Conus* (*Leptoconus*) *Bonneti* Cossmann (1900, *Journ. Conch.*, Vol. XLVIII, p. 59, Pl. IV, figs. 15, 16; = *C. hanza* Noetling (*pars*), 1901, *Pal. Ind.*, new ser., Vol. I, part 3, p. 364, Pl. XXIII, fig. 23, *non* fig. 24). Kama, Kyaungon; also in the Upper Tertiary of Karikal.

Group of *Conus cingulatus* Lamarck (*non* Reeve).

7. *Conus* (*Leptoconus*) *hanza* Noetling (*Pal. Ind.*, new ser., Vol. I, part 3, Pl. XXIII, fig. 24, *non* fig. 23). Kama, Kyudawon, Myaukmigon, Thanga.
8. „ (*Leptoconus*) *aulacophorus* Cossmann (*Journ. Conch.*, 1900, Vol. XLVIII, p. 61, Pl. IV, fig. 19). Upper Tertiary of Karikal.
9. „ (*Leptoconus*) *fasciatus* Martin. Gáj of Sind (identification uncertain).

Group of *Conus Broccii* Bronn.

10. *Conus* (*Leptoconus*) *Yuleianus* Noetling (*Pal. Ind.*, new ser., Vol. I, part 3, p. 363, Pl. XXIII, fig. 22; ?fig. 21). Dalabe, Kyaungon, Myaukmigon, Thanga, Tit-tabwe; ?Thayetmyo.

Group of *Conus Amadis* Martin.

11. *Conus* (*Leptoconus*) *Amadis* Martin. Mekran beds of Baluchistan.
12. „ (*Leptoconus*) *scalaris* Martin. Mekran beds of Baluchistan.

Group of *Conus Sieboläii* Reeve.

13. *Conus* (*Leptoconus*) *marginatus* J. de C. Sowerby. Gáj of Kachh.

? Group of *Conus diversiformis* Deshayes.

14. *Conus* (? *Leptoconus*) *Blaaravei* (= *C. brevis* Sow. ? *sec.* Cossmann and Pissarro, *Pal. Ind.*, new ser., Vol. III, Mem. 1, p. 18, Pl. I, figs. 21, 22). Upper Cuisian, (Upper Ranikot, zone 4) of Sind.

15. *Conus* (? *Lentocoelus*) *subbrevis* d'Archiac and Haime. Eocene of Sind.

Group of *Conus maldivus* Hwass.

16. *Conus* (? *Lithocoelus*) *karikalensis* Cossmann (*Journ. Conch.*, 1900, Vol. XLVIII, p. 56, Pl. IV, fig. 7). Upper Tertiary of Karikal.
17. " (*Lithocoelus*) *maldivus* Hwass (Cossmann, *Journ. Conch.*, 1900, Vol. XLVIII, p. 55, Pl. IV, figs. 5, 6). Upper Tertiary of Karikal.
18. " (*Lithocoelus*) *kyudawonensis* n. sp.

Group of *Conus eburneus* Hwass.

19. *Conus* (*Lithocoelus*) *odengensis* Martin. Dalabe, Kyaungon, Myaukmigon, Thanga, Tittabwe; also in the Gáj of Kachh.
- 19a. " (*Lithocoelus*) *odengensis* var. *avaënsis* Noetling (= *C. literatus* Linn. sec. Noetling, *Pal. Ind.*, new ser., Vol. I, part 3, Pl. XXIII, fig. 13; non figs. 12, 14 = *C. Ickeii*; = *C. avaënsis* Noetling, loc. cit., Pl. XXIII, fig. 15; non fig. 16 = var. *birmanica*). Minbu, Myodaung, Singu, Thayetmyo.
- 19b. " (*Lithocoelus*) *odengensis* var. *birmanica* n. var. (= *C. avaënsis* Noetling, *Pal. Ind.*, new ser., Vol. I, part 3, Pl. XXIII, fig. 16; non fig. 15 = var. *avaënsis*). Prome, zone of *Cytherea promensis*.
20. " (*Lithocoelus*) *djarianensis* Martin. Mekran series of Baluchistan.
21. " (*Lithocoelus*) *myaukmigonensis* n. sp.

Group of *Conus malaccanus* Hwass.

22. *Conus* (*Lithocoelus*) *ineditus* Michelotti (= *C. malaccanus* Hwass sec. Noetling, *Pal. Ind.*, new ser., Vol. I, part 3, p. 360, Pl. XXIII, figs. 17—20). Minbu; Mindegyi, relatively high horizon; Nyaungbintha; Payagyigon; Singu; also in the Nari beds of Sind.
23. " (*Lithocoelus*) *decollatus* Martin. Dalabe, Kyaungon, Myaukmigon, Tittabwe.
24. " (*Lithocoelus*) *brevis* J. de C. Sowerby. Gáj of Kachh.

25. *Conus* (*Lithoconus*) *ngavianus* Martin (= *C. hypermece* Cossmann, *Journ. Conch.*, 1900, Vol. XLVIII, p. 58, Pl. IV, fig. 8). Upper Tertiary of Karikal.
26. „ (*Lithoconus*) *gracilispira* Boettger. Thetkegyin, Kyaukwet Chaung; also in the Upper Eocene of Borneo.

Group of *Conus literatus* Linnæus.

27. *Conus* (*Lithoconus*) *literatus* Linnæus (Cossmann, *Journ. Conch.*, 1900, Vol. XLVIII, p. 54, Pl. IV, fig. 1). Upper Tertiary of Karikal.
28. „ (*Lithoconus*) *Ickei* Martin (= *C. literatus* Linn. sec. Noetling, *Pal. Ind.*, new ser., Vol. I, part 3, Pl. XXIII, figs. 12, 14; non fig. 13 = *C. odengensis* var.). Thayetmyo.
29. „ (*Lithoconus*) *pamotanensis* Martin. Sitsaba.

Group of *Conus figulinus* Linnæus.

30. *Conus* (*Dendroconus*) *Hochstetteri* Martin. Dalabe, Kyaungon, Myaukmigon, Thanga, Tittabwe.
31. „ (*Dendroconus*) *figulinus* Linnæus (Cossmann *Journ. Conch.*, 1900, Vol. XLVIII, p. 52, Pl. IV, fig. 2). Upper Tertiary of Karikal.
32. „ (*Dendroconus*) *Loroisii* Kiener. Mekran Series of Baluchistan.
33. *Conus* (*Dendroconus*) *quercinus* Hwass (Cossmann, *Journ. Conch.*, 1900, Vol. XLVIII, p. 53, Pl. IV, figs. 3, 4). Upper Tertiary of Karikal.

Group of *Conus ponderosus* Brocchi.

34. *Conus* (*Chelyconus*) *minbuensis* n. sp.

CONUS (LITHOCONUS) KYUDA'WONENSIS n. sp.

Pl. XV, fig. 6.

This shell resembles both *Conus Yuleianus* Noetling and *C. odengensis* Martin, thereby illustrating the difficulty of drawing a line of division between the sections *Leptoconus* and *Lithoconus*, as the species first named has essentially the characters of *Leptoconus*, while the second species appears to be a typical *Litho-*

comus. Compared with *Conus Yuleianus*, the shell under consideration is smaller, with a much smaller protoconch, with a generally broader and lower spire, almost entirely lacking the anterior vertical step of the whorls invariably more or less present in *Conus Yuleianus*. Anteriorly to the angulation, the outline of the body-whorl is much stiffer in the shell under consideration than in *Conus Yuleianus*.

The smaller size, the stiffer outline, the more elongate shape, and the small protoconch distinguish it from *Conus odengensis*, the immature specimens of which it closely resembles.

The absence of a stepped disposition of the spire and of a rim to the spire-whorls distinguishes *Conus kyulawonensis* from *Conus ineditus*. The absence of a rim, the more profuse, finer spiral decoration of the spire-whorls, and the almost complete absence of crenulations on the earlier part of the spire distinguish it from *Conus Bonneti* Cossmann.

Conus karikalensis Cossmann (*Journ. Conch.*, Vol. XLVIII, 1900, p. 56, Pl. IV, fig. 7) is practically identical, but is distinguished, according to the published photographic illustration, by its distinctly concave spire-whorls.

Occurrence.—Kyaungo, Kyudawon.

CONUS (LITHOCONUS) MYAUKMIGONENSIS n. sp.

Pl. XV, fig. 7.

Compared with *Conus odengensis*, this shell is distinguished by its more elongate base, its narrower, evenly extraconic spire, the rather conspicuous, even, very crowded spiral decoration of the anterior part of the base. It might be regarded as a variety of *Conus odengensis*, but as it is represented by two specimens from separate localities which agree in all essential characters, and as no intermediate forms have been observed such as might link them with the typical forms of *Conus odengensis*, they may be provisionally regarded as constituting a distinct species.

Occurrence.—Myaukmigon, Thanga.

CONUS (CHELYCONUS) MINBUENSIS n. sp.

Pl. XV, figs. 8, 9.

This species, probably the oldest representative of *Chelyconus* so far known, is related to *Conus ponderosus* Brocchi, and other

allied forms of the newer Tertiary of Europe, some of the varieties of which closely approach the Burmese shell, though the European forms usually have a more curvilinear body-whorl. Amongst living eastern species, *Conus mozambicus* Hwass and *C. prælatus* Hwass (as interpreted by Reeve) appear to be very closely related, but attain somewhat larger dimensions.

Occurrence.—Kyundaw, Minbu.

Family : CANCELLARIIDÆ.

The following species of Cancellariidæ are known at present from the Tertiary formations of India :

Genus : CANCELLARIA Lamarck, 1799.

Cancellaria birmanica n. sp.

Genus : MERICA H. and A. Adams, 1853.

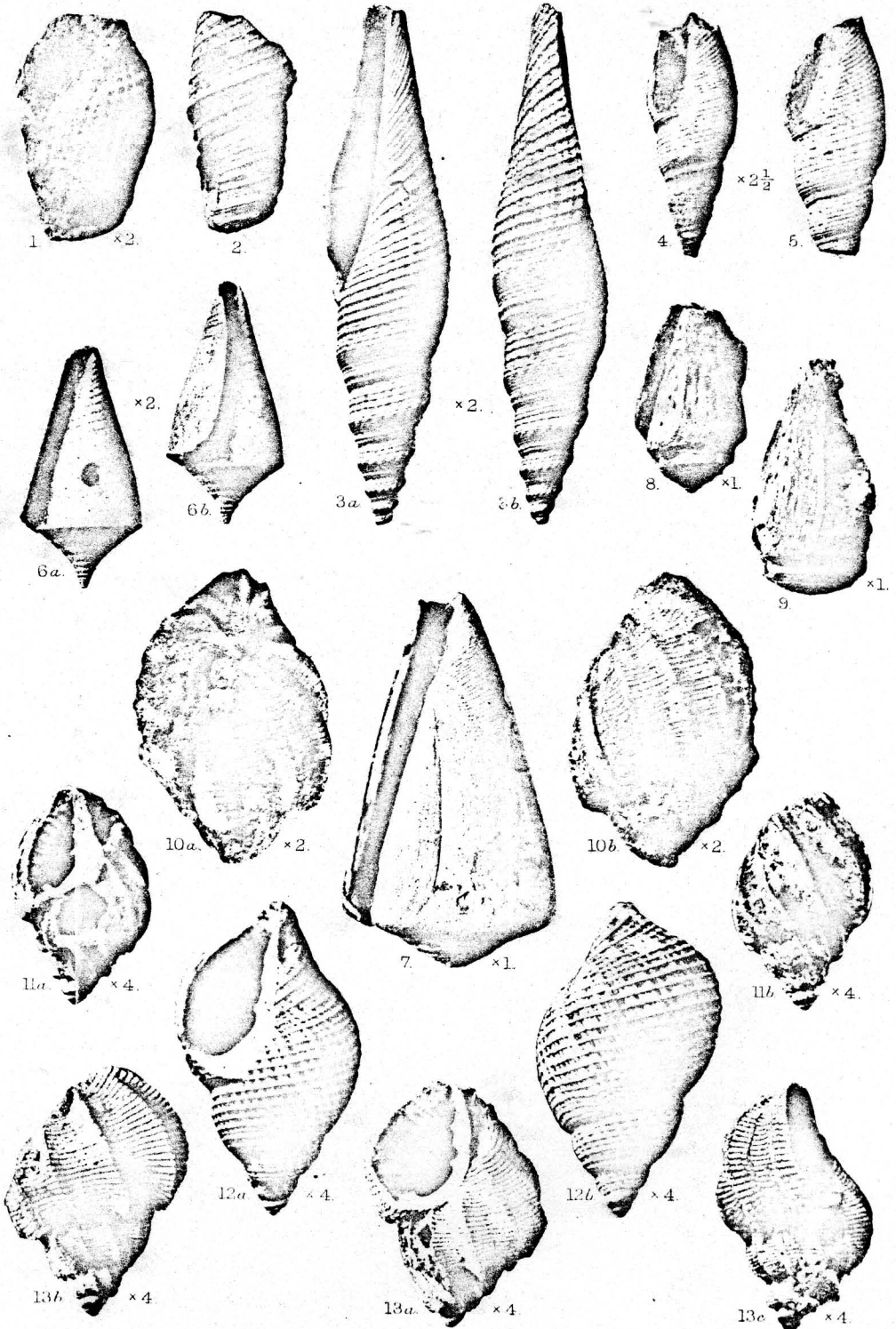
1. *Merica asperella* Lamarck (Cossmann, *Journ. Conch.*, Vol. L. p. 105, Pl. III, figs. 1, 2). Upper Tertiary of Karikal.
2. „ *pseudocancellata* Noetling. Yenangyat.
3. „ *sinensis* Reeve, var. *luteicosta* Kobelt. Myaukmigon.
4. „ *Verbeeki* Martin (Cossmann, *Journ. Conch.*, Vol. L., p. 106, Pl. III, fig. 7). Karikal, Myaukmigon.
5. „ *promensis* n. sp.

Genus : SVELTIA Jousseaume, 1888.

Sveltia Morgani Cossmann (*Journ. Conch.*, Vol. L., p. 107, Pl. III, figs. 3, 4). Upper Tertiary of Karikal.

Genus : TRIGONOSTOMA Blainville, 1826.

1. *Trigonostoma indicum* Vred. Nari of Sind.
2. „ *crispatum* Sow. Upper Tertiary of Karikal ; Talar stage of the Mekran series in Baluchistan.



Photographs by S. C. Mondal.

Phototypes Survey of India Office Calcutta, 1921.