Plate 1.

Fig. 1. Deflandrea phosphoritica EISENACK. a. Upper surface, b. Lower surface, x 400. 6979 Barton. (A/110/1101). Max.length 95u.

Fig. 2. Deflandrea wetzeli MORGENROTH. a. Upper surface, b. Optical section, x 400. 6970 Barton. (A/135/1048). Max.length 95u.

Fig. 3. Wetzeliella (Wetzeliella) articulata EISENACK. Optical section, x 400. 6890 Barton. (E/125/1081). Max.length 100u.

Fig. 4. Wetzeliella (Rhombodinium) sp.1. Upper surface showing archaeopyle, x 400. 6598 Alum Bay. (A/141/1101). Max.length 130u.

Fig. 5. Wetzeliella (Rhombodinium) sp.1. Optical section, x 400. 6985 Barton. (A/129/1105). Max.length 120u.

Fig. 6. Wetzeliella (Wetzeliella) coleothrypta WILLIAMS & DOWNIE. Surface showing cingulum, x 400. 6615 Alum Bay. (A/153/1108). Max.length 100u.

Fig. 7. Wetzeliella (Wetzeliella) coleothrypta WILLIAMS & DOWNIE. a. Optical section, x 400. b. detail cingulum showing ectophragmic membranes x 1000. 6625 Alum Bay (A/117/1035). Max.length 100u.

Fig. 8. Wetzeliella (Wetzeliella) cf. reticulata WILLIAMS & DOWNIE. a. Upper surface, x 400. b. detail apical horn showing reticulum, x 1000. 6889 Barton (E/143/1070). Max. width 110u.

Fig. 9. Hystrichosphaera ramosa (EHRENBERG) var. indet. Upper surface, x 400. 6975 Barton (A/078/1132). Max.diam.50u.

Fig.10. Hystrichosphaera ramosa (EHRENBERG) var.membranacea (ROSSIGNOL). a. Upper surface, b. Optical section, x 400. 6971 Barton. (A/098/1071). Max.length 95u.

Fig.11. Hystrichosphaera crassipellis DEFLANDRE & COOKSON. Optical section, x 400. 6912 Barton. (A/121/1103). Max.diam 100u.

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PLATE 1

1a

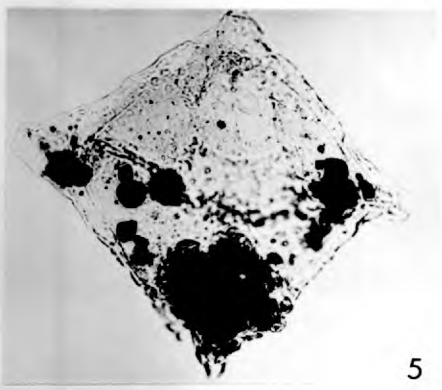
1b

2a

2b

3

4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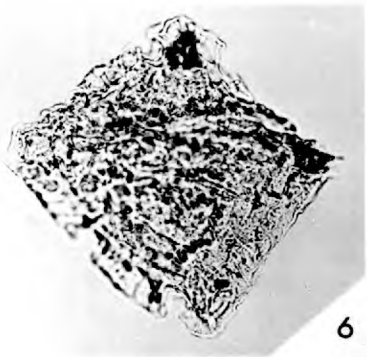
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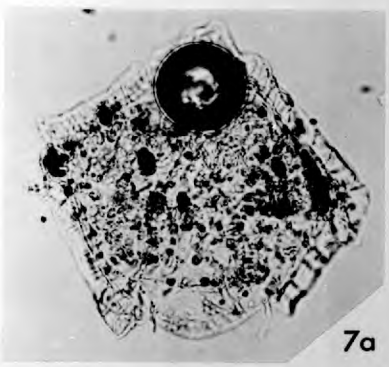
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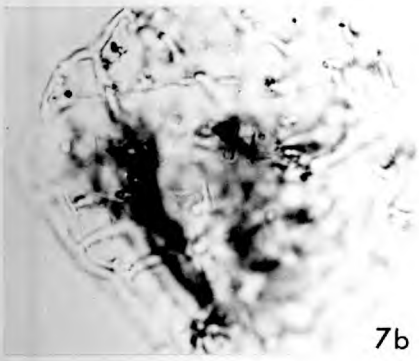
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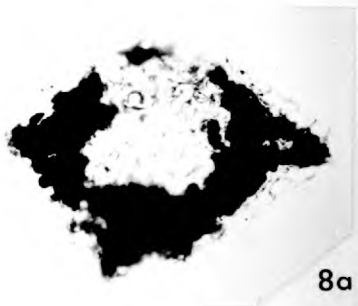
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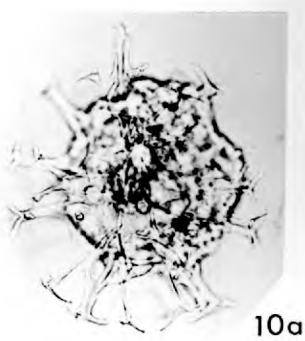
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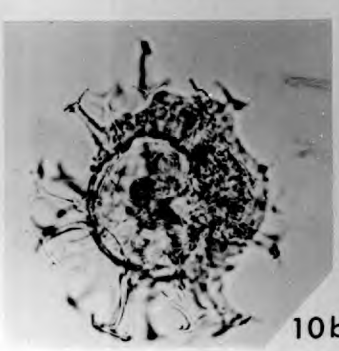
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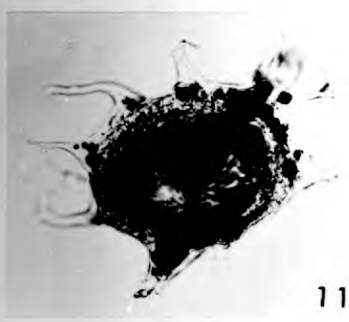
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Plate 2.

Fig. 1. Achmosphaera ramulifera (DEFLANDRE). a. Upper surface, b.Optical section, x 400. 6625 Alum Bay. (A/075/1052).Max.diam.100u.

Fig. 2. Achmosphaera alcicornu (EISENACK). a. Upper apical surface, b. Optical section, x 400. 6942 Barton (A/114/1067).Max.diam.105u.

Fig. 3. Achmosphaera alcicornu (EISENACK). A. Upper lateral surface and archaeopyle. b. Optical section, x 400. 6900 Barton (A/084/1079). Max.diam.85u.

Fig. 4. Areoligera sp.1. Upper lateral, whole specimen, archaeopyle attached (to left), x 400. 6880 Barton (A/114/1020). Max.diam. 120u.

Fig. 5. Areoligera sp.1. a. Upper lateral surface. b. Lower lateral surface, archaeopyle detached, x 400. 6964 Barton (C/152/1043). Max.width 90u.

Fig. 6. Areoligera sp.1. a. Upper lateral surface. b. Lower lateral surface, archaeopyle detached, x 400. 6981 Barton. (A/133/1082). Max. width 95u.

Fig. 7. Adnatosphaeridium sp.1. a. Optical section and archaeopyle margin (archaeopyle detached). b. Upper lateral surface showing distal process reticulum, x 400. 6964 Barton. (B/122/1061). Max.width 80u.

Fig. 8. Hystrichosphaeridium salpingophorum (DEFLANDRE). Apical view showing archaeopyle, x 400. 6912 Barton. (B/112/1108). Max.diam. 110u.

Fig. 9. Hystrichosphaeridium salpingophorum (DEFLANDRE). Lateral view showing narrow processes, x 400. 6912 Barton. (B/078/1124). Max.diam.110u.

Fig.10. Hystrichosphaeridium salpingophorum (DEFLANDRE). Detail process (Stereoscan), about x 1600. 6906 Barton. (Single grain slide 10).

Fig.11. Hystrichosphaeridium salpingophorum (DEFLANDRE). Lateral view showing broad processes, x 400. 6894 Barton. (C/139/1100). Max.diam. 110u.

Fig.12. Hystrichosphaeridium aff.latirictum DAVEY & WILLIAMS. a. Upper lateral surface. b. Optical section, x 400. 6967 Barton. (A/118/1105). Max.diam. 95u.

Fig.13. Hystrichosphaeridium sp.1. Lateral surface showing archaeopyle (detached), x 400. 6900 Barton. (A/132/1122). Max.diam.95u.

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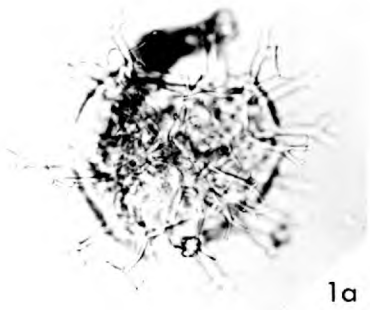
PLATE 2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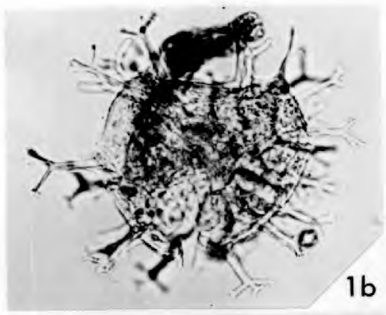
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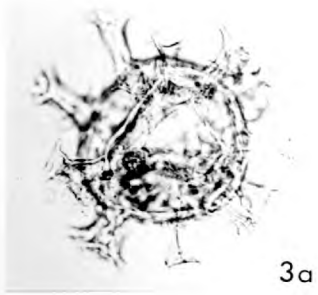
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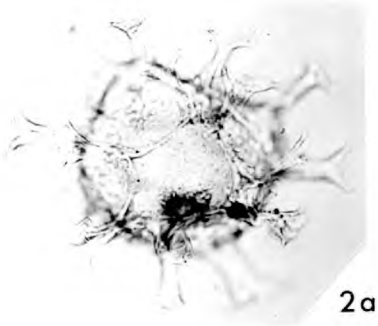
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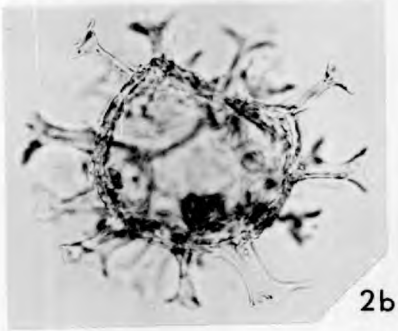
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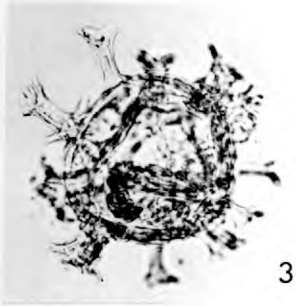
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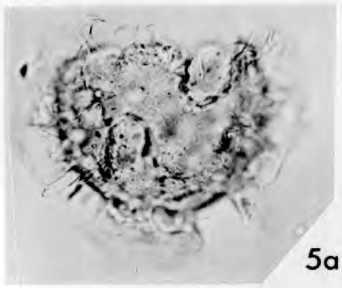
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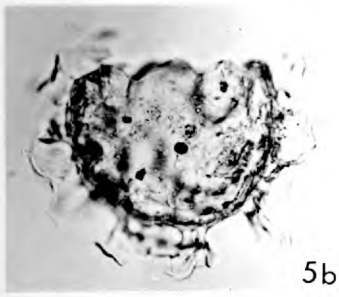
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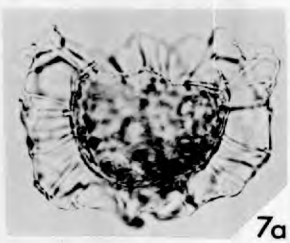
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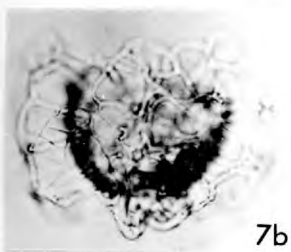
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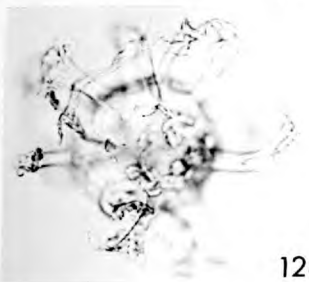
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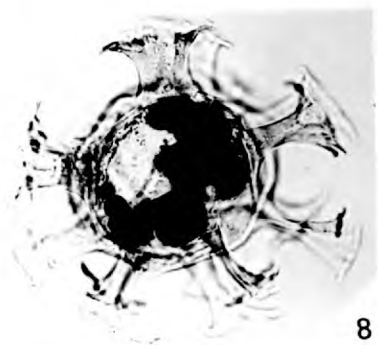
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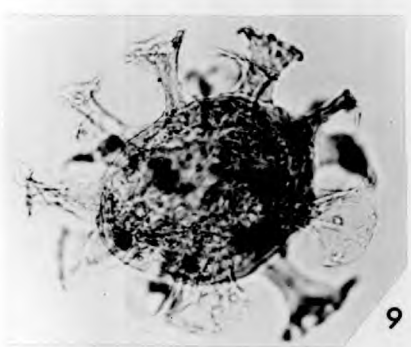
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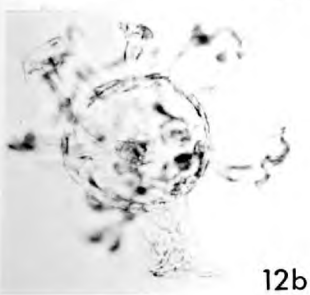
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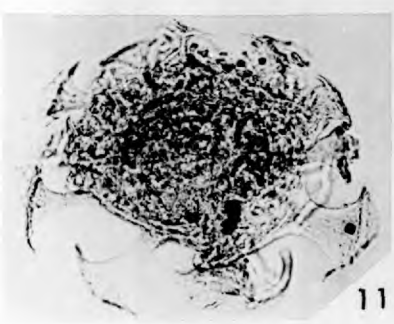
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13

Plate 3.

Fig. 1. Oligosphaeridium dictyoplokus (KLUMPP). a. Oblique apical surface view showing archaeopyle. b. showing processes, x 400. 6889 Barton. (E/145/1105). Max.diam.125u.

Fig. 2. Oligosphaeridium dictyoplokus (KLUMPP). Lateral view showing process terminations, x 400. 6930 Barton. (A/079/1102). Max.diam.115u.

Fig. 3. Oligosphaeridium dictyoplokus (KLUMPP). Detail process termination (Stereoscan), about x 2000. 6906 Barton. (single grain slide 7).

Fig. 4. Oligosphaeridium dictyoplokus (KLUMPP). Lateral view showing archaeopyle, x 400. 6912 Barton. (B/080/1128).Max.width 105u.

Fig. 5. Oligosphaeridium dictyoplokus (KLUMPP). Lateral view showing broad processes, x 400. 6900 Barton. (A/093/1064).Max.diam.100u.

Fig. 6. Oligosphaeridium sp.1. Lateral view showing archaeopyle (still attached) and broad processes, x 400. 6942 Barton. (A/094/1091). Max.diam.120u.

Fig. 7. Oligosphaeridium sp. 1. Lateral view showing narrow processes, x 400. 6926 Barton. (A/052/1056). Max.diam.110u.

Fig. 8. Cordosphaeridium inodes (KLUMPP). Surface showing elongate process, x 400. 6981 Barton. (A/110/1102). Max.diam.100u.

Fig. 9. Cordosphaeridium inodes (KLUMPP). Lateral surface showing short processes and archaeopyle, x 400. 6937 Barton (A/118/1067). Max.diam. 90u.

Fig.10. Cordosphaeridium inodes (KLUMPP). Detail surface and process (Stereoscan), about x 1000. 6981 Barton. (Single grain slide 4).

Fig.11. Cordosphaeridium gracilis (EISENACK). a.Surface apical view showing archaeopyle. b. Optical section, x 400. 6894 Barton. (C/150/1068). Max.diam.120u.

Fig.12. Cordosphaeridium gracilis (EISENACK). Optical section of small form, x 400. 6625 Alum Bay. (A/119/1099). Max.diam.95u.

Fig.13. Polysphaeridium subtile DAVEY & WILLIAMS. Surface view, x 400. 6912 Barton. (B/084/1063). Max.diam.80u.

Fig.14. Homotryblium pallidum DAVEY & WILLIAMS. a.Surface view showing epitractal archaeopyle and sulcal notch. b. Optical section showing processes, x 400. 7152 Barton (A/100/1076). Max.diam.70u.

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PLATE 3

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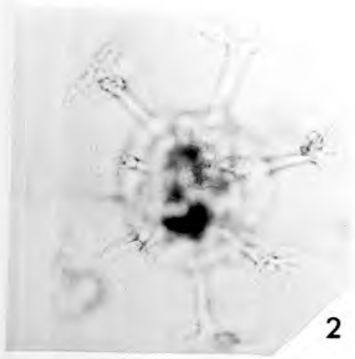
1b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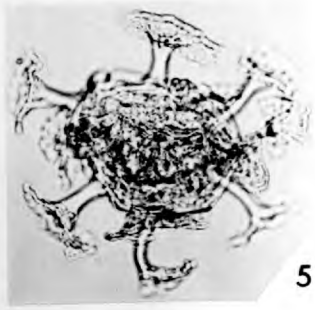
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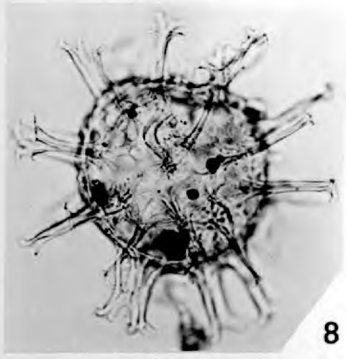
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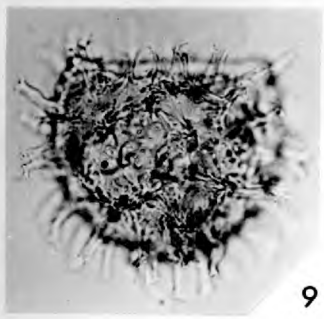
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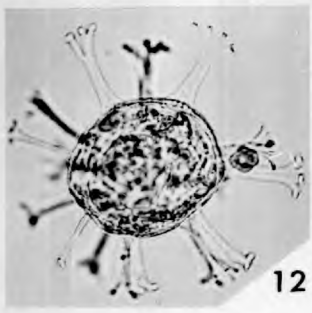
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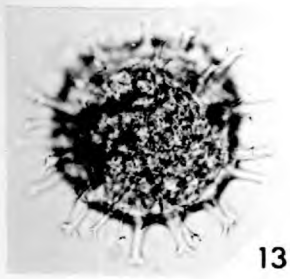
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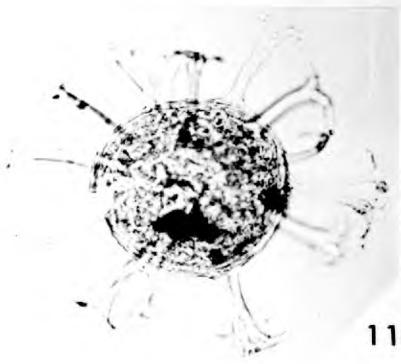
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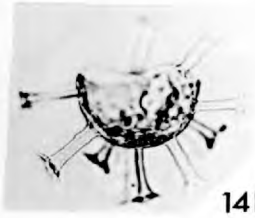
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Plate 4

Fig. 1. Cleistosphaeridium centrocarpum (DEFLANDRE & COOKSON). a. Surface lateral view. b. Optical section, x 400. 6974 Barton. (A/114/1119). Max. width 100u.

Fig. 2. Cleistosphaeridium centrocarpum (DEFLANDRE & COOKSON). Surface lateral view of elongate specimen, x 400. 6889 Barton. (E/100/1034). Max. length 90u.

Fig. 3. Hystrichokolpoma eisenacki WILLIAMS & DOWNIE. a. Lower lateral surface. b. Upper lateral surface, x 400. 6937 Barton (A/1373119). Max.length 95u.

Fig. 4. Hystrichokolpoma biformoides (EISENACK). a. Lower lateral surface. b. Upper lateral surface and archaeopyle, x 400. 6974 Barton. (A/149/1099). Max.diam.70u.

Fig. 5. Lanternosphaeridium axialis (EISENACK). a. Optical section. b. Upper lateral surface, archaeopyle (still attached) and apical process, x 400. 6894 Barton. (C/092/1010). Max.diam.110u.

Fig. 6. Lanternosphaeridium axialis (EISENACK). Optical section, x 400. 6889 Barton. (B/124/1101). Max.diam.130u.

Fig. 7. Palmnickia sp.1. Surface lateral view showing archaeopyle,x 400. 6978 Barton. (A/140/1050). Max.length 110u.

Fig. 8. Palmnickia sp.1. Surface lateral view, x 400. 6975 Barton. (A/107/1086). Max.length 125u.

Fig. 9. Kenleyia? sp.1. a. Surface lateral view showing archaeopyle. b. Opposite surface showing sulcus, x 400. 6969 Barton. (A/130/1128). Max.length 100u.

Fig.10. Dinoflagellate Incertae Sedis sp.1. Surface view, x 400. 6975 Barton (A/097/1089). Max.width 80u.

Fig.11. Thalassiphora pelagica (EISENACK). Oblique lateral view of "juvenile" form, x 400. 6979 Barton. (A/110/1101). Max.diam.75u.

Fig.12. Thalassiphora pelagica (EISENACK). a. Surface lateral view. b. Optical section showing short periphragmic antapical process, x 400. 6980 Barton. (A/080/1045). Max.diam. 140u.

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PLATE 4

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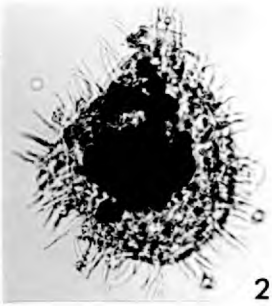
1b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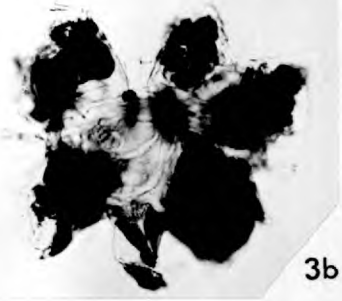
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4b

5a

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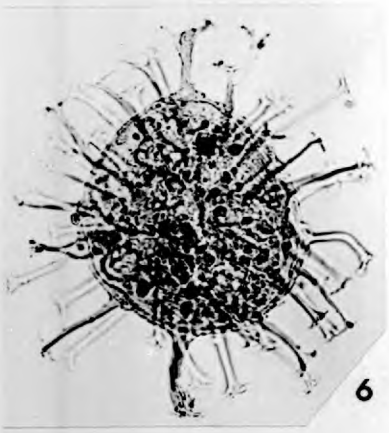
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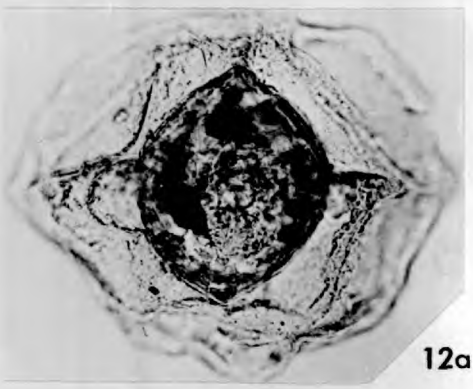
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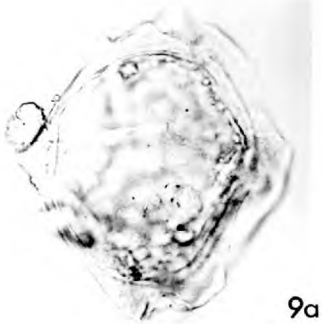
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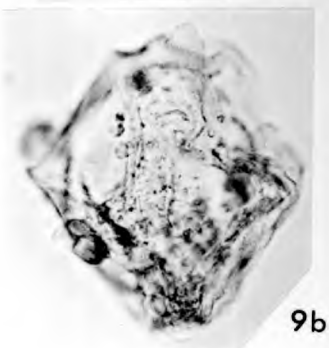
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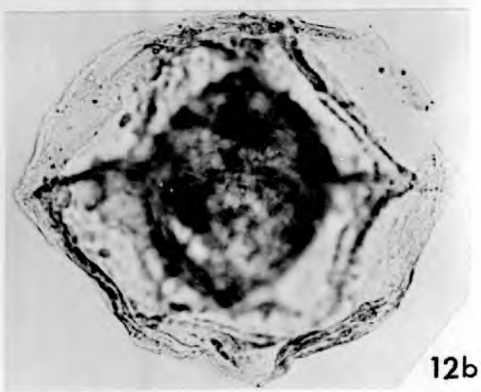
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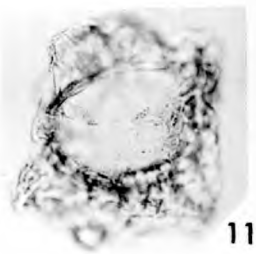
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Plate 5.

Fig. 1. Tasmanites suevicus (EISENACK). a. Whole specimen, x 300. b. Detail wall structure in optical section, x 1000. c. Detail surface wall structure showing pore groups, x 1000. 6917 Barton. (A/080/1090). Diam. 115u, wall th. 6u.

Fig. 2. Tasmanites sp.2. a. Whole specimen in optical section, x 300. b. Detail optical section and wall structure, x 1000. c. Detail wall surface, x 1000. 6963 Barton. (A/120/1080). Diam. 125u, wall th. 7u.

Fig. 3. Tasmanites sp.1. a. Whole specimen in optical section, x 300. b. Detail optical section wall, x 1000. c. Detail wall surface and pores, x 1000. 6942 Barton. (A/120/1090). Diam. 140u, th.7u.

Fig. 4. Tytthodiscus cf. californiensis NOREM. a. Surface, whole specimen, x 400. b. Detail wall structure in optical section, x 2000. c. Detail wall surface and pores, x 1000. 6613 Alum Bay. (A/152/1051). Diam. 100u, wall th. 3.5u.

Fig. 5. Tytthodiscus chondrotus NOREM. Optical section of specimen with internal swellings, x 300. 6917 Barton. (A/090/1110). Diam. 107u, wall th. 13u.

Fig. 6. Tytthodiscus chondrotus NOREM. a. Optical section, b. Surface view, both x 300. 6968 Barton. (A/130/1130). Diam.120u,wall th.10u.

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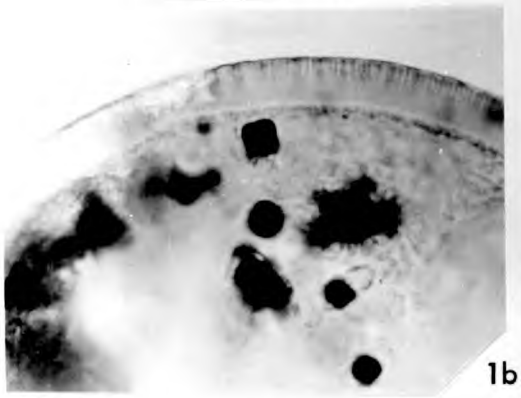
PLATE 5

1a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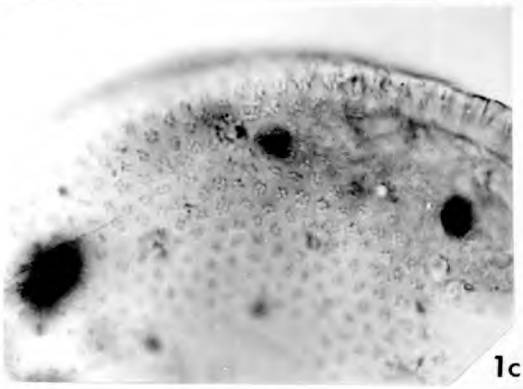
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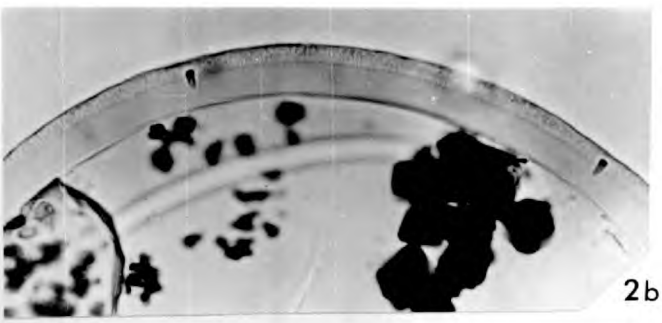
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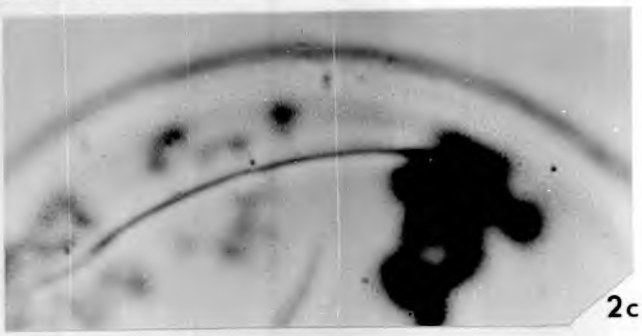
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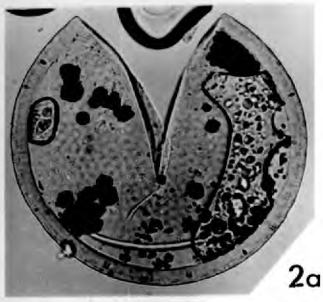
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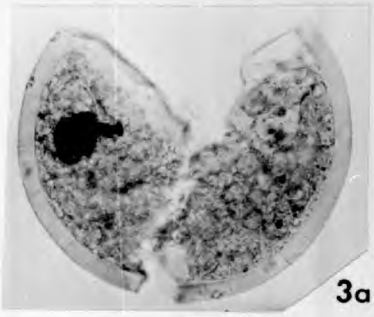
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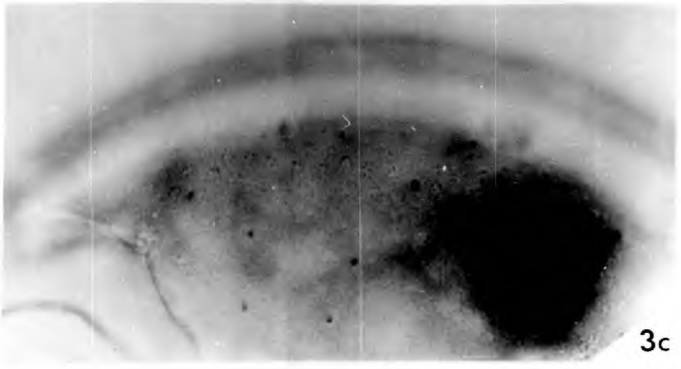
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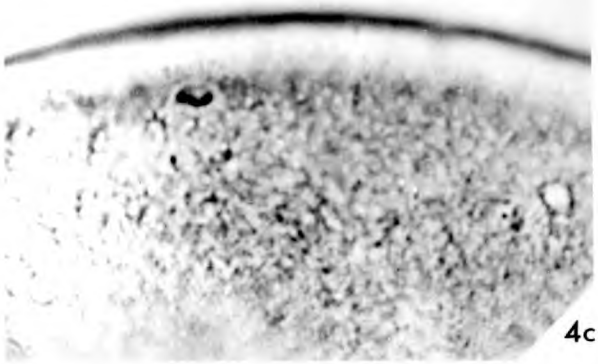
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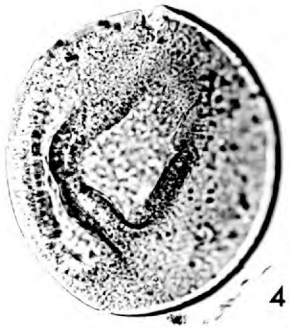
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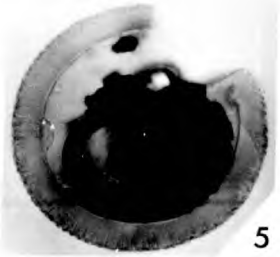
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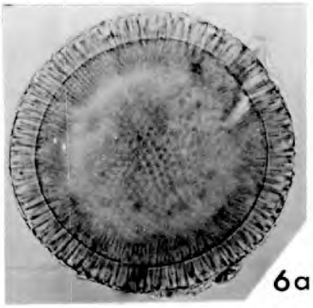
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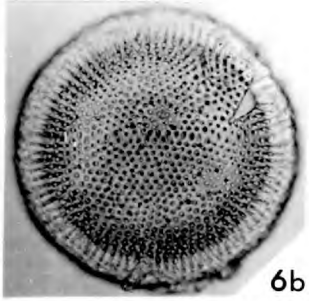
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Plate 6.

Fig. 1. Tytthodiscus chondrotus NOREM. a. Detail optical section of wall. b. Detail wall surface and pores, both x 1000. Same spec. as pl.5, fig. 6.

Fig. 2. Leiosphaeridia ralla FELIX. Surface view, x 300. 6894 Barton. (B/150/1060). Max.diam.130u.

Fig. 3. Leiosphaeridia sp.2. a. Optical section, x 300. b. Detail wall in optical section, x 1000. 6906 Barton. (A/150/1190). Diam.120u, wall th. 3u.

Fig. 4. Leiosphaeridia? sp.3. a. Optical section of whole specimen. b. wall surface, both x 300. c. Detail wall structure in optical section. d. Detail wall surface, both x 1000. 6986 Barton. (A/130/1060). Diam. 145u, wall th.6u.

Fig. 5. Pterospermopsis cf. danica W.WETZEL. Optical section, x 400.6595 Alum Bay. (A/146/1086). Max.diam.145u.

Fig. 6. Leiosphaeridia sp.5. Optical section, x 400. 6596 Alum Bay. (A/124/1077). Max.length 170u.

Fig. 7. Oudhkusumites cf. foveolatus SRIVASTAVA. a. Whole specimen, x 400. b. Detail peripheral region, x 1000. 6634 Alum Bay. (A/114/1135). Max.diam.100u.

Fig. 8. Incertae Sedis sp.3. a. Surface view. b.Optical section, x 400. 6989 Barton (A/130/1063). Max.length 95u.

Fig. 9. Incertae Sedis sp.2. Optical section, x 400. 6968 Barton. (A/123/1078). Max.diam.70u.

Fig. 10. Incertae Sedis sp.1. Whole specimen (Stereoscan), x 100. 6634 Alum Bay. Max.diam. 325u. (N.B. specimen exploded during removal from stub).

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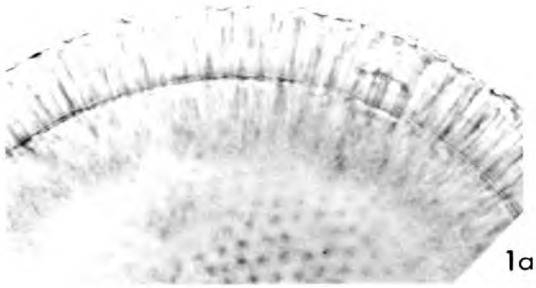
PLATE 6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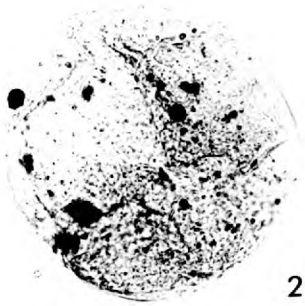
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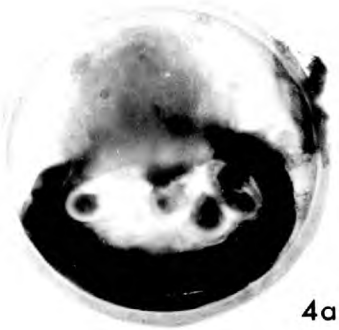
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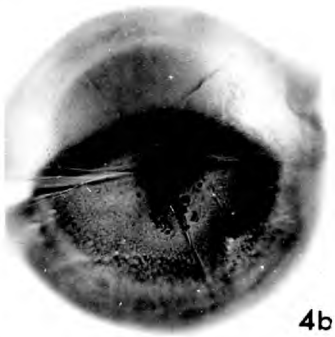
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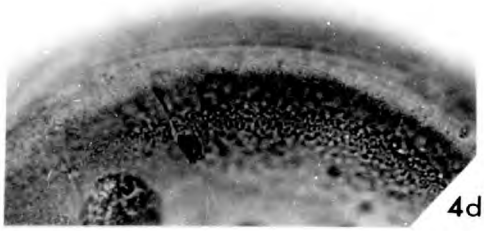
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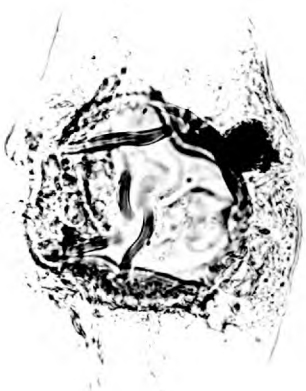
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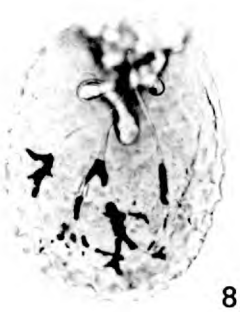
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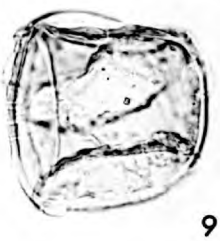
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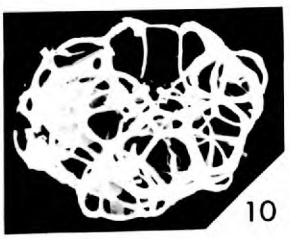
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Plate 7.

Fig. 1. Psammosphaera ? sp.2. a. Lateral, b. Peripheral view, x100, 6891 Barton. Max.diam. 475u.

Fig. 2. Glomospirella sp.1. Lateral view, x 100. 6982 Barton. Max.diam450u.

Fig. 3. Reophax sp.1. Lateral view, x 100. 7152 Barton. Length 625 u.

Fig. 4. Reophax sp.1. Lateral view of more coarsely agglutinated specimen, x 100. 6624 Alum Bay.Length 828u.

Fig. 5. Cribrostomoides pauperata (CHAPMAN) a.Lateral, b.Peripheral views of uncompressed specimen, x 100. 6950 Barton. Max.diam. 275u.

Fig. 6. Cribrostomoides pauperata (CHAPMAN) Laterally compressed specimen, x 100. 7194 Hengistbury Head. Max.diam. 450u.

Fig. 7. Cribrostomoides pauperata (CHAPMAN) Laterally compressed specimen, x 100. 6885 Barton. Max.diam. 400u.

Fig. 8. Cribrostomoides sp.3. a.Apertural, b. Lateral views, x 100. 6950 Barton. Max. diam. 500u.

Fig. 9. Ammobaculites sp.1. a.Lateral, b.Apertural views, x 100. 6886 Barton. Length 525u.

Fig.10. Ammobaculites sp.1. Lateral view of form with longer uncoiled portion, x 100. 6601 Alum Bay. Length 575u.

Fig.11. Ammobaculites sp.2. Lateral view, x 100. 6606 Alum Bay. Length 500u.

Fig.12. Ammobaculites sp.2. Lateral view of form with longer uncoiled portion, x 100. 7159 Hengistbury Head.Length 675u.

Fig.13. Trochammina sp.1. a.Dorsal, b.Apertural, C.Ventral views, x 100. 6951 Barton. Max.diam.300u.

Fig.14. Textularia? sp.1. x 100. 6909 Barton. Length 375u.

Fig.15. Verneuilina sp.1. x 100. 6885 Barton. Length 400u.

Fig.16. Gaudryina sp.1. Slightly compressed specimen, x 100. 6885 Barton. Length 462u.

Fig.17. Gaudryina sp.1. Uncompressed specimen, x 100. 7194 Hengistbury Head. Length 575u.

Fig.18. Gaudryina sp.2. Short, uncompressed specimen, x 100. 6951 Barton. Length 375u.

Fig.19. Gaudryina sp.1. Longer compressed specimen, x 100. 6885 Barton, Length 450u.

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PLATE 7

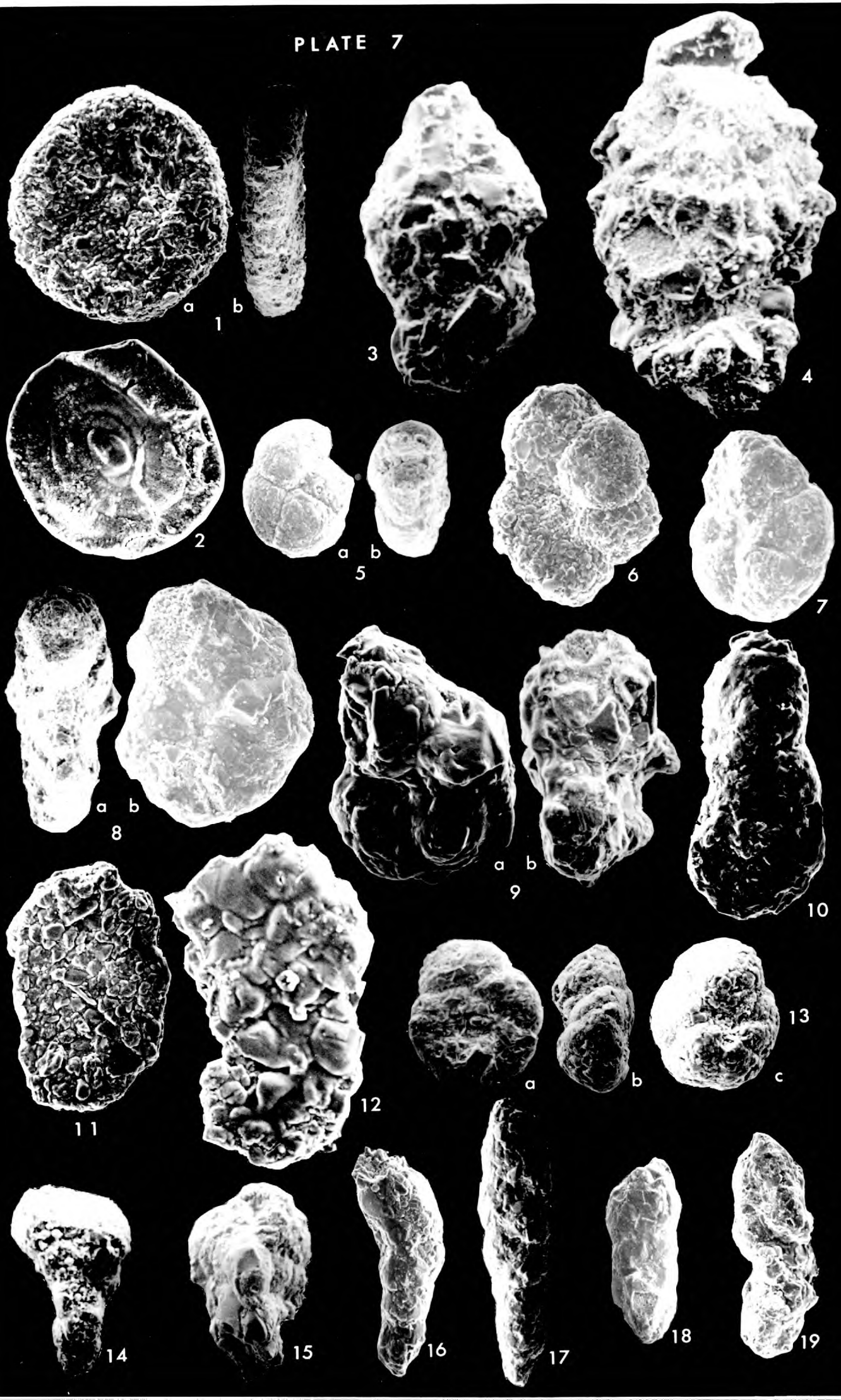

Plate 8.

Fig. 1. Cyclogyra bornemanni (REUSS). a.Lateral, b.apertural views, x 100. 6961 Barton. Max.diam. 525u.

Fig. 2. Spiroloculina? sp.1. a. Lateral, b. apertural views, x 100. 6950 Barton. Length 700u.

Fig. 3. Quinqueloculina seminulum (LINNE): a, b. Opposite sides of adult, x 100. 6946 Barton. Length 712u.

Fig. 4. Quinqueloculina seminulum (LINNE). a, b. Opposite sides of juvenile specimen, x 100. 6946 Barton. Length 525u.

Fig. 5. Quinqueloculina aff. carinata D'ORBIGNY. a,b. Opposite faces of adult, x 100. 6946 Barton. Length 575u.

Fig. 6. Quinqueloculina aff.carinata D'ORBIGNY. a,b. Opposite faces of juvenile, x 100. 6946 Barton. Length 375u.

Fig. 7. Quinqueloculina bicarinata D'ORBIGNY. Adult specimen, x 50. 6683 Alum Bay. Length 1700u.

Fig. 8. Quinqueloculina bicarinata D'ORBIGNY. Juvenile specimen, x 50. 6683 Alum Bay. Length 1025u.

Fig. 9. Quinqueloculina juleana D'ORBIGNY. a,b. Opposite sides, x 50. 6946 Barton. Length 900u.

Fig. 10. Quinqueloculina sp.12.a,b. Opposite faces, x 100. 6600 Alum Bay. Length 225u.

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PLATE 8

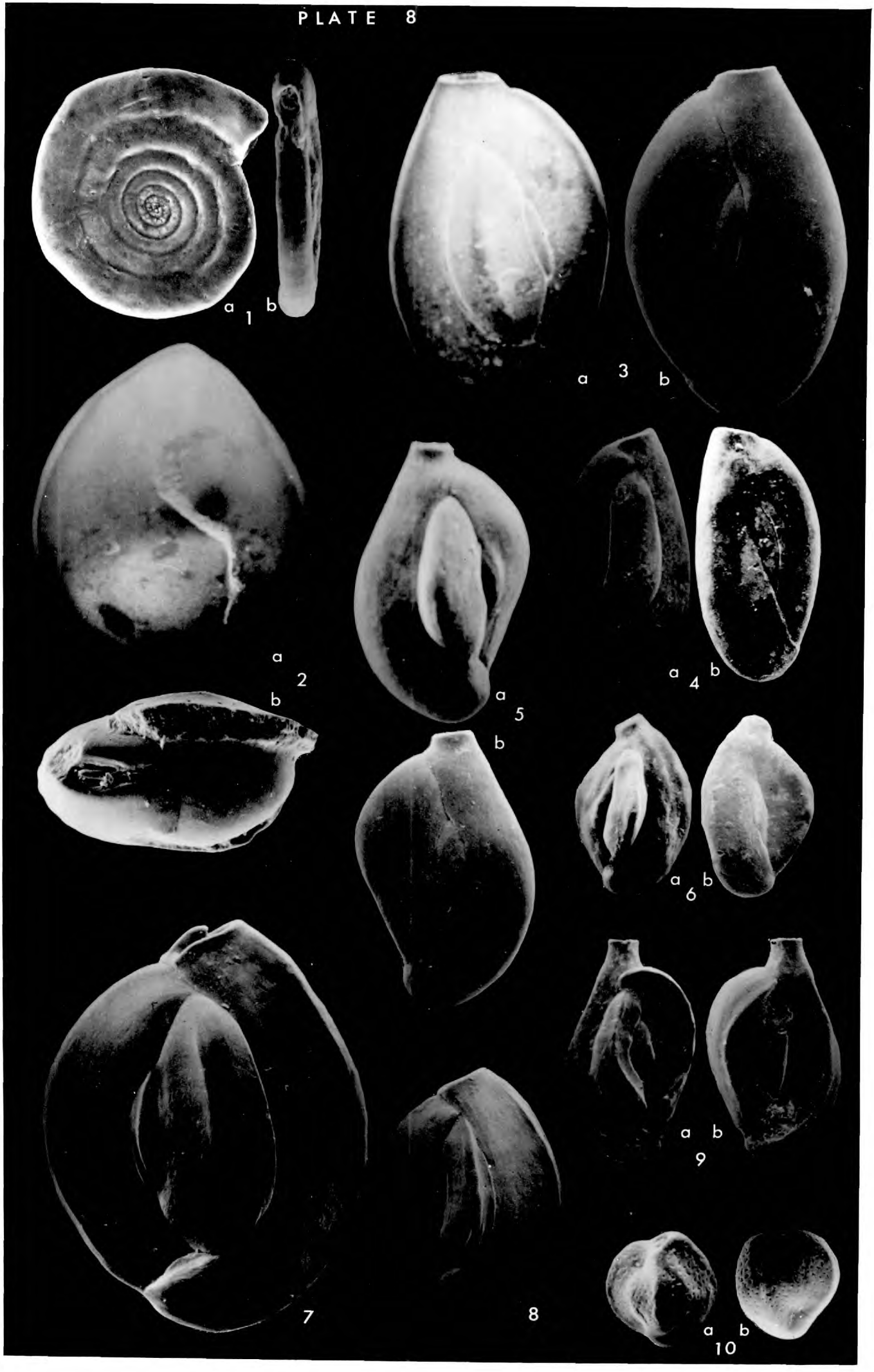

Plate 9.

Fig. 1. Quinqueloculina impressa REUSS. Adult specimen. a,b. Opposite sides, x 100. 6946 Barton. Length 687u.

Fig. 2. Quinqueloculina impressa REUSS. Juvenile specimen. a,b. Opposite sides, x 100. 6946 Barton. Length 525u.

Fig. 3. Quinqueloculina impressa var. 1. Adult specimen. a. Apertural, b. lateral views, x 100. 6951 Barton. Length 825u.

Fig. 4. Quinqueloculina impressa var. 1. Juvenile specimen. a,b. Opposite lateral faces, x 100. 6951 Barton. Length 450u.

Fig. 5. Quinqueloculina costata KARRER. a,b. Opposite sides, x 50. 6946 Barton. Length 1725u.

Fig. 6. Quinqueloculina ludwigi REUSS. a,b. Opposite sides, x 100. 6691 Alum Bay. Length 700u.

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PLATE 9

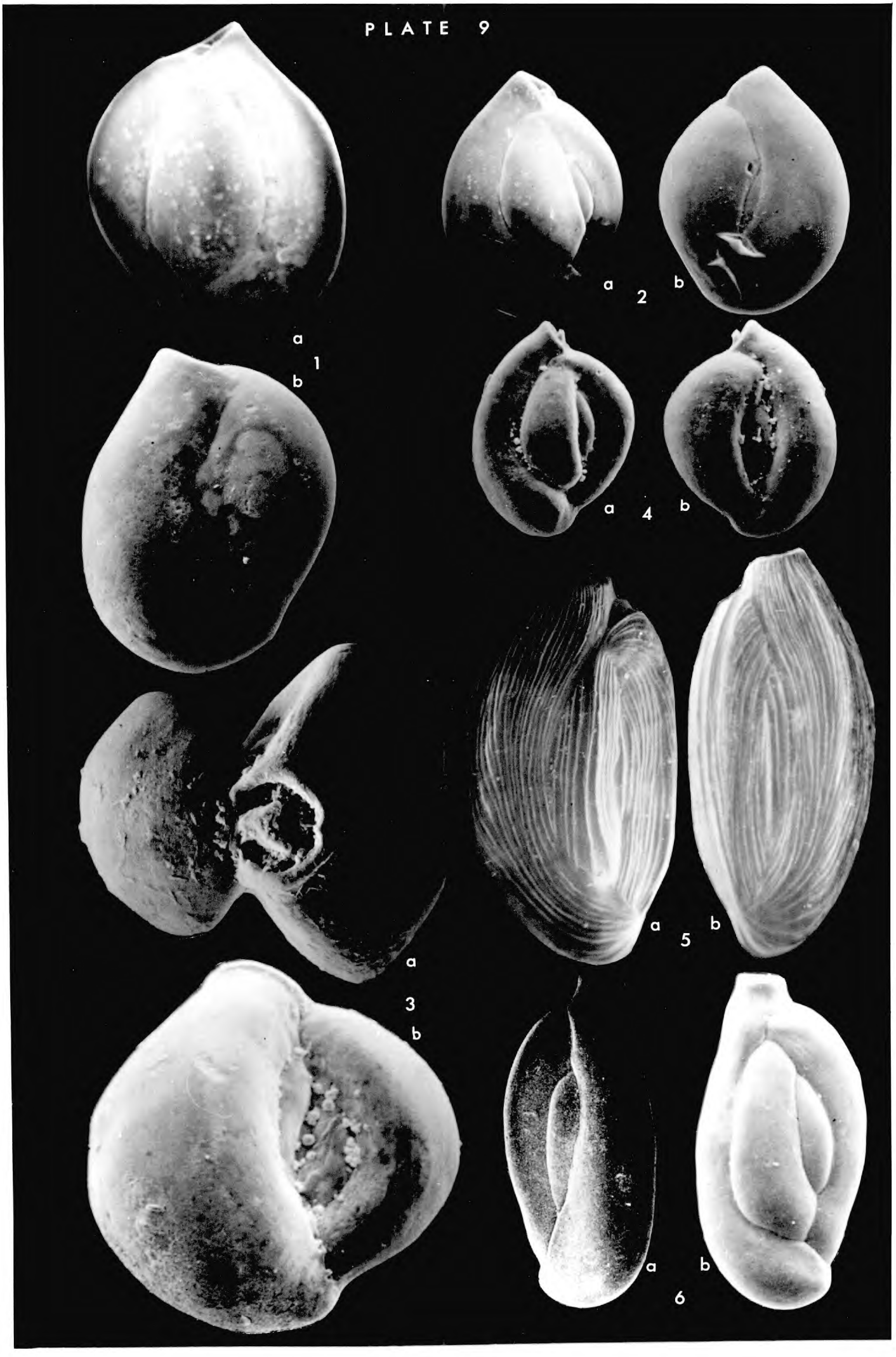

Plate 10.

Fig. 1. Triloculina trigonula (LAMARCK). a,b, Opposite sides, x 200. 6681 Alum Bay. Length 250u.

Fig. 2. Miliolinella oblonga (MONTAGU). a,b. Opposite sides, x 100. 6947 Barton. Length 450u.

Fig. 3. Fabularia bella KAASSCHIETER. Lateral view of well preserved specimen, x 50. 6600 Alum Bay. Length 1050u.

Fig. 4. Fabularia bella KAASSCHIETER. a.Apertural, b.lateral views of worn specimen showing chamber partitions, x 50. 6954 Barton. Width 900u.

Fig. 5. Nodosaria cf. pyrula D'ORBIGNY. x 100. 6940 Barton.Length 700u.

Fig. 6. Nodosaria sp.3. x 200, 6937 Barton. Length 200u.

Fig. 7. Nodosaria sp.4. x 200. 6938 Barton. Length 175u.

Fig. 8. Dentalina cf. ewaldi (REUSS). x 100. 6591 Alum Bay. Length 437u.

Fig. 9. Dentalina inornata D'ORBIGNY. x 100. 6586 Alum Bay. Length 575u.

Fig.10. Dentalina sp.2. x 100. 6938 Barton. Length 325u.

Fig.11. Dentalina sp.4. x 100. 6952 Barton. Length 875u.

Fig.12. Lagena globosa (MONTAGU). x 100. 6587 Alum Bay.Length 300u.

Fig.13. Lagena cf. hexagona (WILLIAMSON). x 100. 6677 Alum Bay. Length 325u.

Fig.14. Lagena cf. lagenoides (WILLIAMSON). x 200. 6940 Barton. Length 175u.

Fig.15. Lagena striata (D'ORBIGNY). Globular specimen x 100. 6940 Barton. Length 272u.

Fig.16. Lagena striata (D'ORBIGNY). More elongate specimen, x 100. 6940 Barton. Length 375u.

Fig.17. Lagena cf. tenuis (BORNEMANN). x 100. 6617 Alum Bay.Length 250u.

Fig.18. Lagena sp.1. x 100. 6940 Barton. Length 262u.

Fig.19. Saracenaria cf. bottcheri (REUSS). x 100. 6938 Barton.Length 237u.

Fig.20. Pseudarcella campanula LE CALVEZ. a.Lateral, b. Basal views, x 100. 6586 Alum Bay. Basal diam. 300u.

Fig.21. Lenticulina cf. ellisori BOWEN. a. Lateral, b. peripheral views, x 100. 6941 Barton. Max.diam. 662u.

Fig.22. Lenticulina cf. limbosa (REUSS). a.Lateral, b. peripheral views, x 100. 6602 Alum Bay. Max.diam. 450u.

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PLATE 10

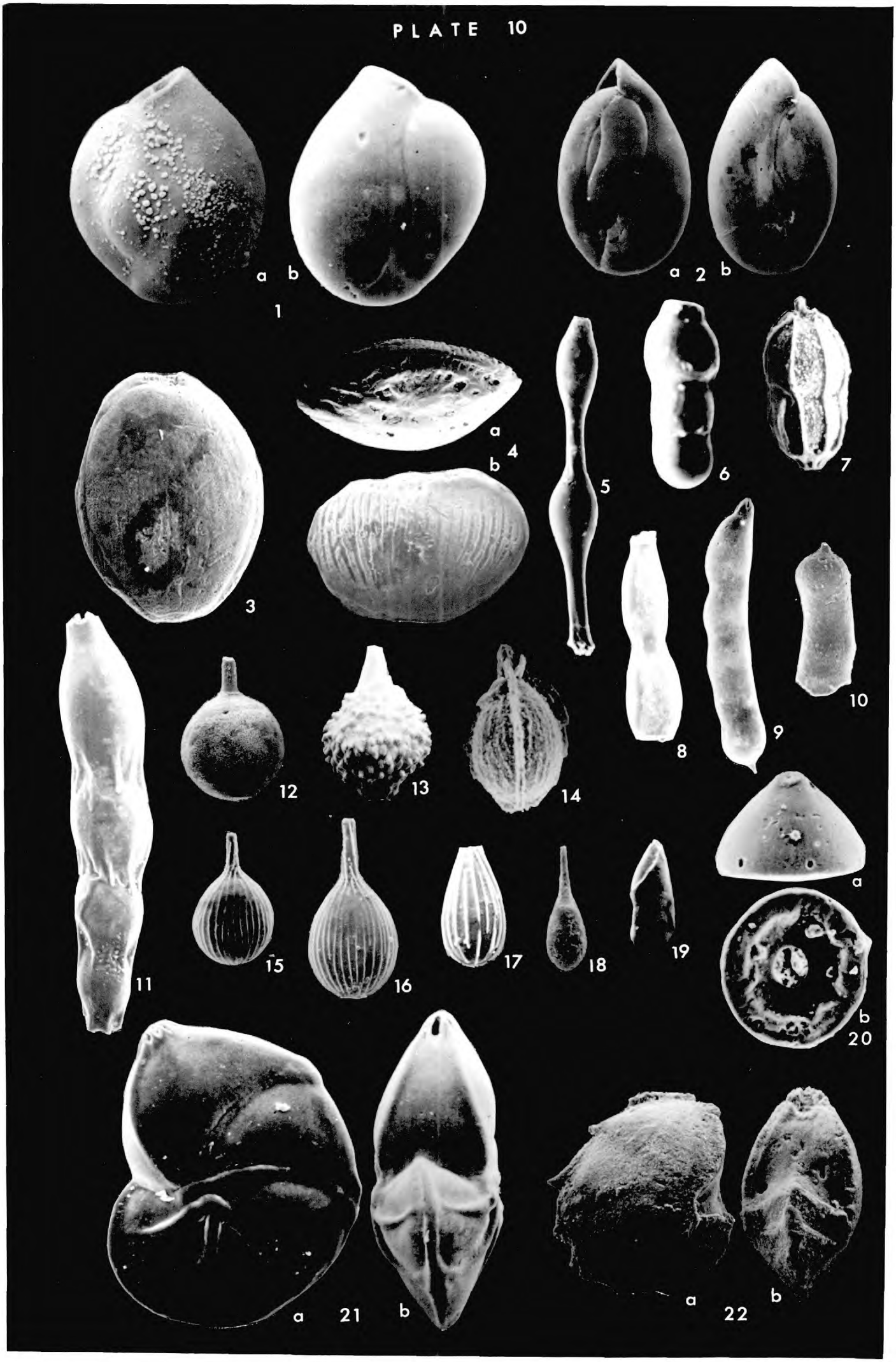

Plate 11.

Fig. 1. Lenticulina cf. yaguatensis (BERMUDEZ). a. Lateral, b.peripheral views of large umbonate specimen, x 50. 6642 Alum Bay. Max.diam.925u.

Fig. 2. Lenticulina cf. yaguatensis (BERMUDEZ). a.Lateral, b.peripheral views of smaller specimen, x 100. 6642 Alum Bay. Max.diam.512u.

Fig. 3. Lenticulina sp.1. a.Lateral, b.peripheral views, x100. 6588 Alum Bay. Max.diam. 500u.

Fig. 4. Globulina gibba (D'ORBIGNY). Globular specimen, x 100. 6946 Barton. Length 337u.

Fig. 5. Globulina gibba (D'ORBIGNY). Elongate specimen, x 100. 6946 Barton. Length 462u.

Fig. 6. Globulina gibba (D'ORBIGNY), Specimen with fistulose final chamber, x 100. 6936 Barton. Length 300u.

Fig. 7. Globulina gibba var.punctata D'ORBIGNY. x 100. 6586 Alum Bay.Length 350u.

Fig. 8. Globulina gibba var. myristiformis (WILLIAMSON). x 100. 6964 Barton. Length 525u.

Fig. 9. Guttulina irregularis (D'ORBIGNY). x 200. 6940 Barton. Length 187u.

Fig.10. Sigmormorphina sp.1. x 100. 6938 Barton. Length 900u.

Fig.11. Guttulina irregularis var.bulloides (REUSS). x 100. 6963. Barton. Length 550u.

Fig.12.Guttulina irregularis var. bulloides (REUSS). x 100. 7041 FISHER's bed XVII. Upper Bracklesham Beds, Whitecliff Bay. Length 450u.

Fig.13. Guttulina cf.pulchella D'ORBIGNY. x 100. 6587 Alum Bay. Length 350u. (N.B. unique specimen exploded in Stereoscan).

Fig.14. Guttulina pulchella D'ORBIGNY. x 100. 7037 FISHER's bed XVII, Upper Bracklesham Beds, Whitecliff Bay. Length 400u.

Fig.15. Guttulina lactea (WALKER & JACOB). x 100. 6940 Barton. Length 300u.

Fig.16. Guttulina problema (D'ORBIGNY). x 100. 6679 Alum Bay.Length 425u.

Fig.17. Pyrulina thouini (D'ORBIGNY). x100. 6586 Alum Bay. Length 550u.

Fig.18. Glandulina laevigata (D'ORBIGNY). Inflated specimen, x 100. 6960 Barton. Length 600u.

Fig.19. Glandulina laevigata (D'ORBIGNY). Less inflated specimen, x 100. 6960 Barton. Length 625u.

Fig.20. Fissurina laevigata REUSS. x 300. 6940 Barton. Length 150u.

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PLATE 11

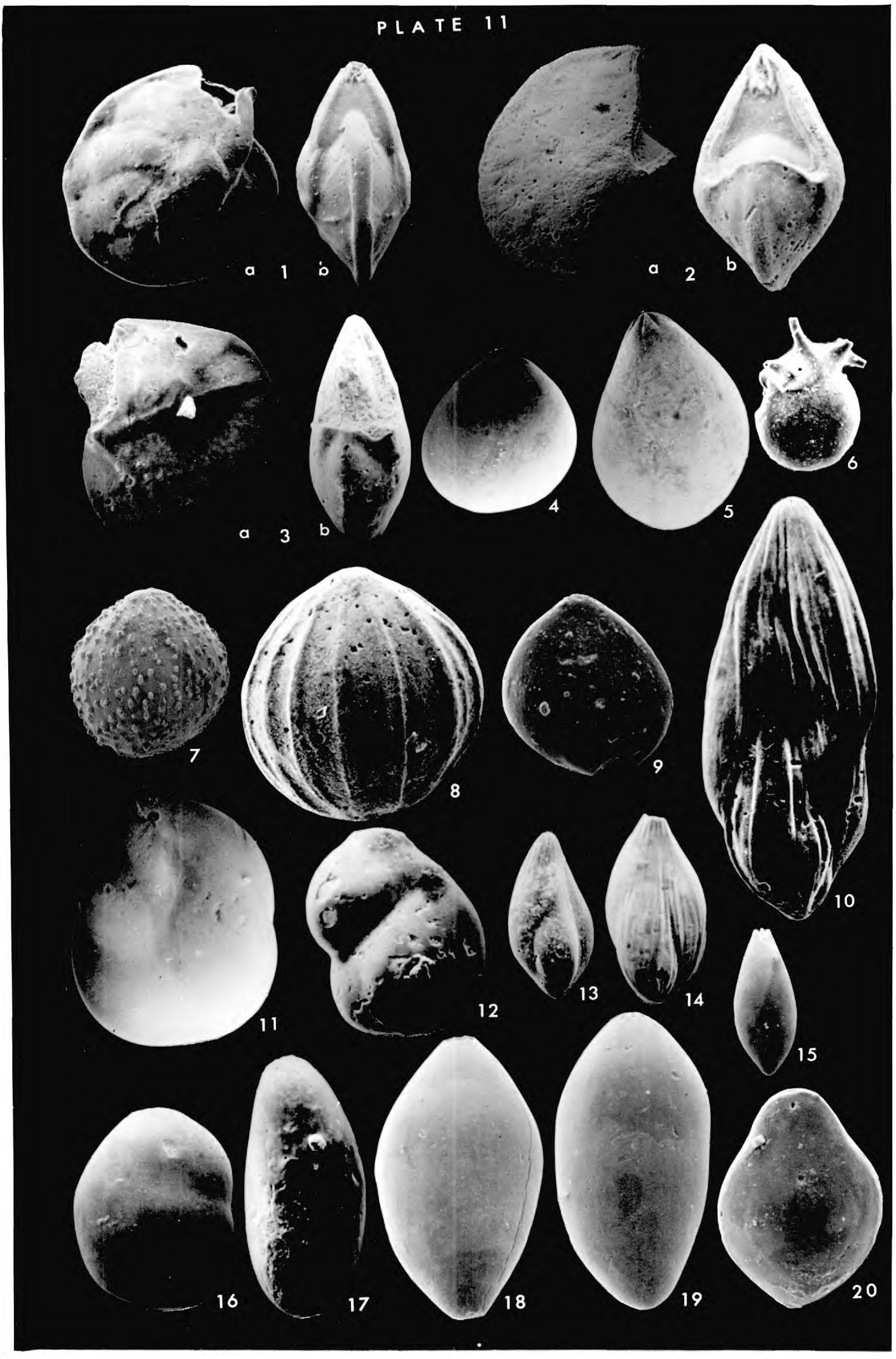

Plate 12.

Fig. 1. Buliminella cf.elegantissima (D'ORBIGNY). a,b.Opposite faces, x 200. 6627 Alum Bay. Length 137u. (apertural view from drawing of water immersed specimen).

Fig. 2. Buliminella carteri BHATIA. Apertural view, x 200. 6964 Barton. Length 112u.

Fig. 3. Bolivina anglica CUSHMAN. x 100. 6631 Alum Bay. Length 225u.

Fig. 4. Bolivina cookei CUSHMAN. x 100. 6928 Barton. Length 375u.

Fig. 5. Bolivina crenulata CUSHMAN. x 100. 6940 Barton. Length 250u.

Fig. 6. Bolivina pulchra (TERQUEM). x 100. 6631 Alum Bay. Length 325u.

Fig. 7. Bulimina parisiensis KAASSCHIETER. x 200. 6905 Barton. Length 275u.

Fig. 8. Praeglobobulimina cf. pupoides D'ORBIGNY. x 200. 6964 Barton. Length 250u.

Fig. 9. Sagrina sp.2. Elongate specimen, x 200. 6940 Barton. Length 225u.

Fig.10. Sagrina sp.2. Juvenile specimen with aboral spine, x 200. 6940 Barton. Length 150u.

Fig.11. Reussella cf. elongata (TERQUEM). x100. 6587 Alum Bay. Length 250u.

Fig.12. Angulogerina muralis (TERQUEM). x 200. 6641 Alum Bay. Length 175u.

Fig.13. Eoeponidella sp.1. a,b,c. Dorsal, apertural and ventral views, x 200. 6905 Barton. Max.diam. 250u.

Fig.14. Epistominella? sp.1. a,b. Dorsal, apertural views, x 200. 6639 Alum Bay. Max.diam.187u.

Fig.15. Baggina subconica (TERQUEM). a,b,c. Dorsal, apertural and ventral views, x 200. 6926 Barton. Max.diam. 275u.

Fig.16. Spirillina simplex LE CALVEZ. a,b. Lateral and apertural views, x 200. 6885 Barton. Max.diam. 200u.

Fig.17. Globigerina cf.angustiumbilicata BOLLI. a,b,c. Dorsal, apertural and ventral views, x 300. 6959 Barton. Max.diam. 200u.

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PLATE 12

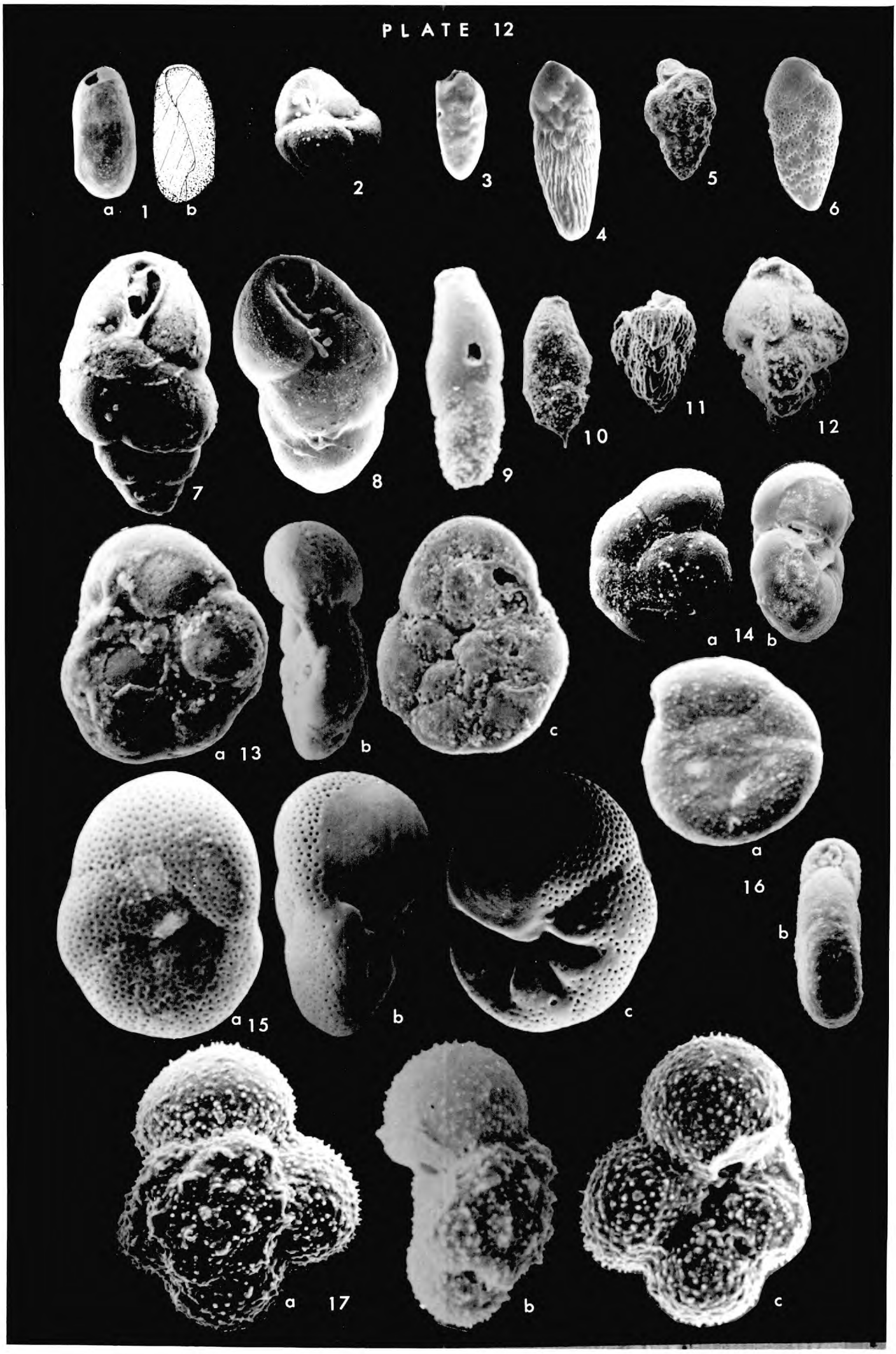

Plate 13.

Fig. 1. Asterigerina bartoniana (TEN DAM). a,b,c. Dorsal, ventral and apertural views, x 100. 7152 Barton. Max.diam. 925u.

Fig. 2. Rotalia propingua REUSS. a,b,c. Dorsal, apertural and ventral views, x 200. 6947 Barton. Max.diam. 237u.

Fig. 3. Asterigerina brandhorstiana GRAMANN. a,b,c. Dorsal, apertural and ventral views, x 100. 6669 Alum Bay. Max.diam. 350u.

Fig. 4. Pararotalia inermis (TERQUEM). a,b,c. Dorsal, apertural and ventral views, x 100. 6960 Barton. Max.diam. 550u.

Fig. 5. Pararotalia spinigera (LE CALVEZ). a,b,c. Dorsal, apertural and ventral views, x 200. 6944 Barton. Max.diam. 275u.

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PLATE 13

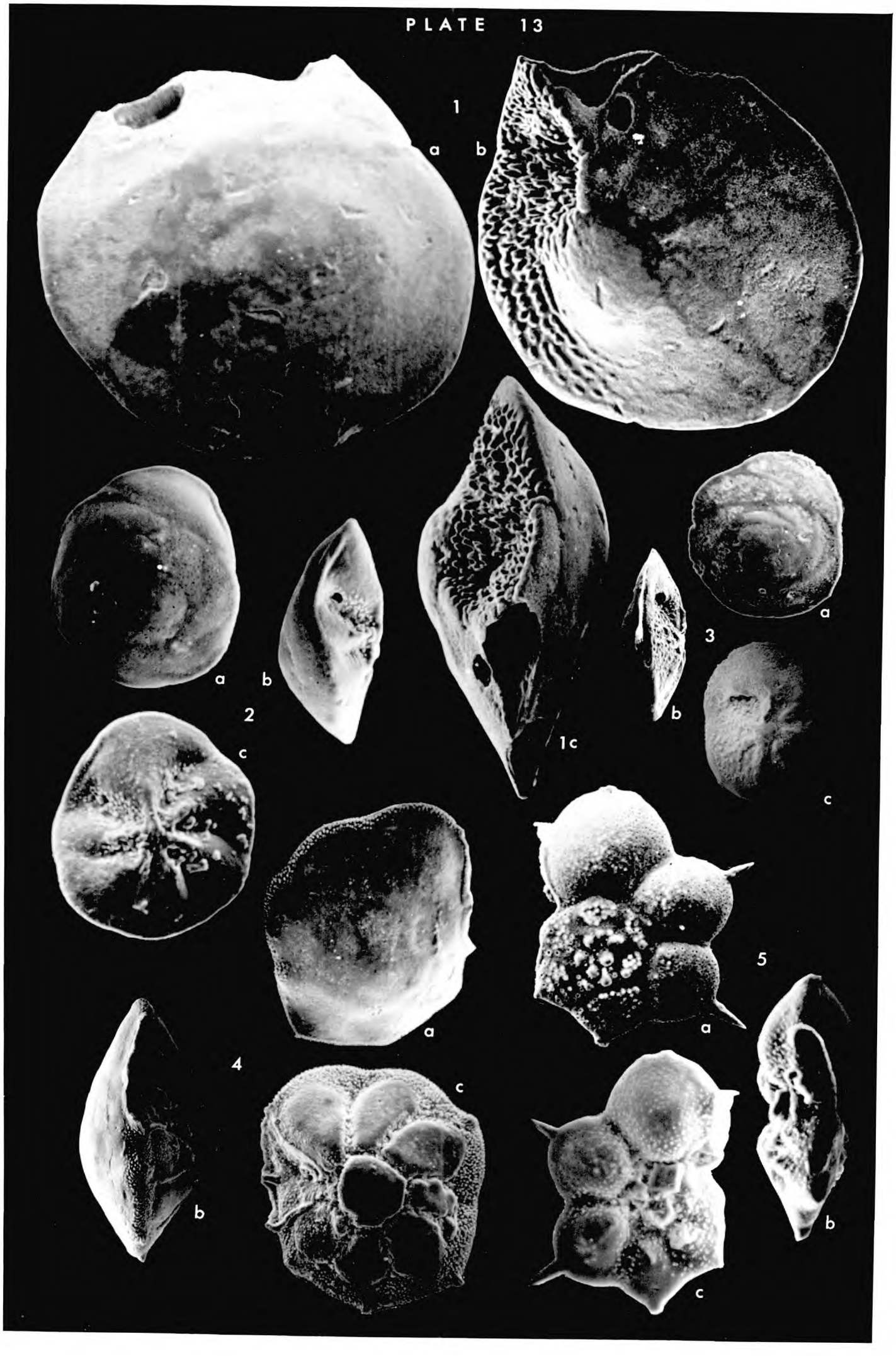

Plate 14.

Fig. 1. Elphidium cf.hiltermanni HAGN. a,b. Lateral and apertural views, x 100. 6591 Alum Bay. Max.diam. 325u.

Fig. 2. Elphidium laeve (D'ORBIGNY). a,b. Lateral and apertural views, x 100. 6960 Barton. Max.diam. 412u.

Fig. 3. Elphidium subnodosum (ROEMER). a,b. Lateral and apertural views, x 100. 6681 Alum Bay. Max.diam. 350u.

Fig. 4. Elphidium latidorsatum (REUSS). a,b. Lateral and apertural views, x 100. 6940 Barton. Max.diam. 325u.

Fig. 5. Elphidium sp.4. a,b. Lateral and apertural views, x 100. 6640 Alum Bay. Max.diam. 450u.

Fig. 6. Fursenkoina cf. schriebersiana (CZJZEK). x 100. 6940 Barton. Length 325u.

Fig. 7. Cibicides pygmeus (HANTKEN). a,b,c. Dorsal, apertural and ventral views, x 100. 6949 Barton. Max.diam. 425u.

Fig. 8. Cibicides carinatus (TERQUEM). a,b.c. Dorsal, apertural and ventral views, x 100. 6941 Barton. Max.diam. 387u.

Fig. 9. Cibicides lobatulus (WALKER & JACOB). a,b,c. Dorsal, apertural and ventral views, x 100. 6586 Alum Bay. Max.diam. 275u.

Fig.10. Cibicides cf.tenellus (REUSS). a,b,c. Dorsal, apertural and ventral views, x 100. 6949 Barton. Max.diam. 350u.

Fig.11. Cibicides ungerianus (D'ORBIGNY). a,b,c. Dorsal, apertural and oblique ventral views, x 100. 6900 Barton. Max.diam 325u.

Fig.12. Cibicides vialovi BYKOVA. a,b,c. Dorsal, apertural and ventral views, x 100. 6960 Barton. Max.diam. 425u.

Fig.13. Nonion affine (REUSS). a,b. Lateral and apertural views, x 100. 6942 Barton. Max.diam. 350u.

Fig.14. Nonion graniferum (TERQUEM). a,b. Lateral and apertural views, x 100. 6586 Alum Bay. Max.diam. 275u.

Fig.15. Nonion sp.8. a,b. Lateral and apertural views, x 200. 6941 Barton. Max.diam. 200u.

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PLATE 14

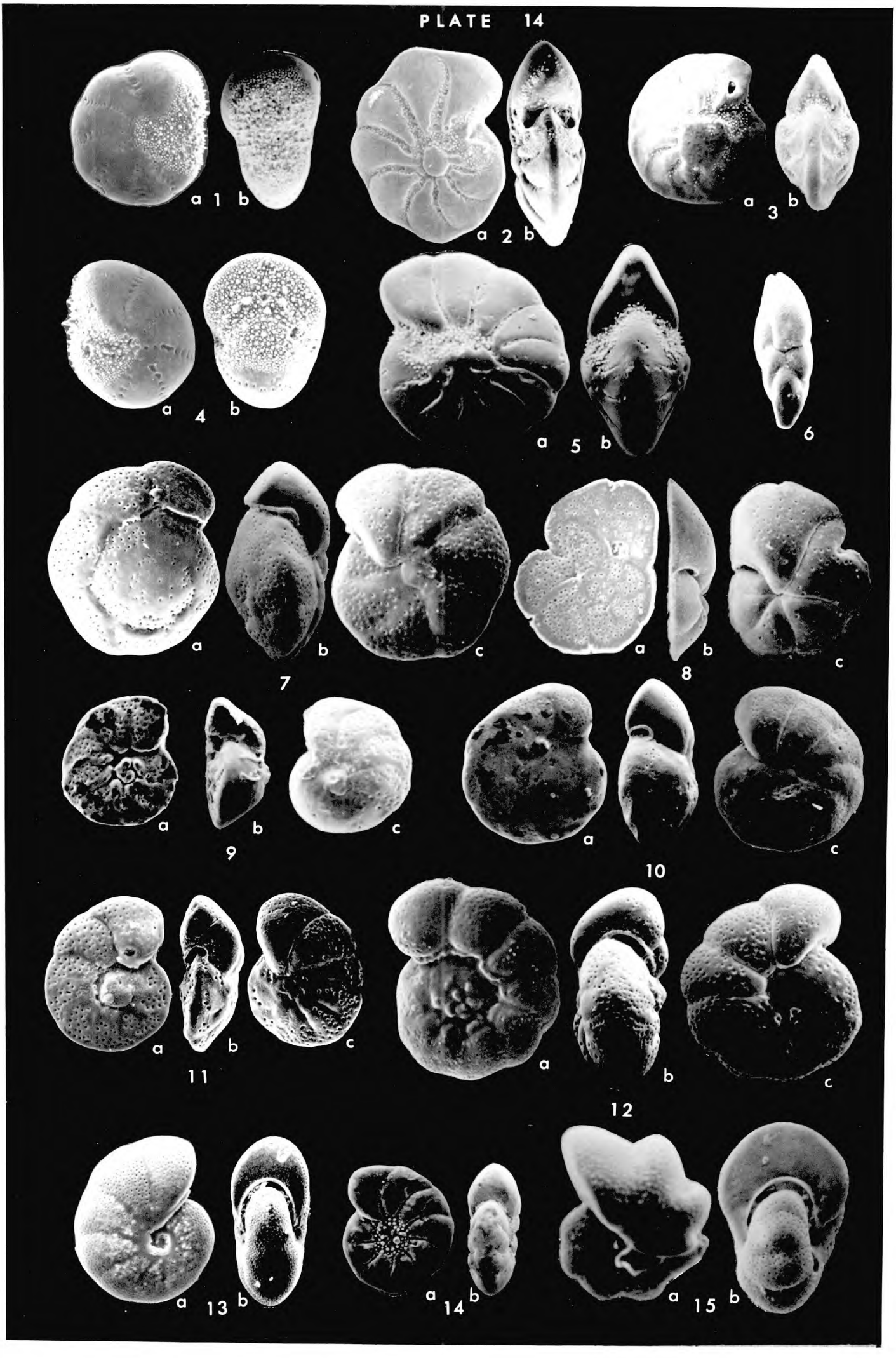
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Plate 15.

Fig. 1. Nonionella spissa CUSHMAN. a,b.Dorsal and apertural views, x 200. 6939 Barton. Max.diam.162u.

Fig. 2. Pullenia quinqueloba (REUSS). a,b. Lateral and apertural views, x 200. 6940 Barton. Max.diam.200u.

Fig. 3. Robertina germanica CUSHMAN & PARKER. a,b.Opposite views, x 100. 6947 Barton. Length 400u.

Fig. 4. ?Hanzawaia producta (TERQUEM). a,b,c. Dorsal apertural and ventral views, x 200. 6905 Barton. Max.diam. 200u.

Fig. 5. Hanzawaia producta (TERQUEM). a,b.Dorsal and ventral views, x 100. 7041 bed XVII, Up.Bracklesham Beds, Whitecliff Bay.Max.diam.375u.

Fig. 6. "Microforaminiferid". Lateral view in transmitted light, x 400. 6962 Barton (A/147/1083). Max.diam. 150u.

Fig. 7. Nummulites prestwichianus (JONES). Lateral view, x 20. 6586 Alum Bay (no.2). Max.diam. 2950u.

Fig. 8. Nummulites prestwichianus (JONES). Equatorial split, A form, x 20. 6586 Alum Bay (no.10). Max.diam. 2600u.

Fig. 9. Nummulites prestwichianus (JONES). Equatorial split, B form, x 20. 6586 Alum Bay (no.15). Max.diam.1650u.

Fig.10. Nummulites rectus CURRY. Lateral view adult, x 20. 6912 Barton (no.3). Max.diam. 2700u.

Fig.11. Nummulites rectus CURRY. Lateral view, juvenile, x 20. 6912 Barton (no.5). Max.diam. 1750u.

Fig.12. Nummulites rectus CURRY. Equatorial split, A form, x 20. 6912 Barton (no.14). Max.diam. 1950u.

Fig.13. Nummulites rectus CURRY. Transverse split, x 20. 6915 Barton (no.5). Max.diam.1800u.

Fig.14. Nummulites variolarius var.1. Lateral view, x 20. 7030 bed XIV/XV, Upper Bracklesham Beds, Whitecliff Bay (no.1).Max.diam.1350u.

Fig.15. Nummulites variolarius var.1. Lateral view, x 20. 7030 bed XIV/XV, Upper Bracklesham Beds, Whitecliff Bay (no.2). Max.diam. 1150u.

Fig.16. Nummulites variolarius var.1. Equatorial split, A form, x 20. 7030 bed XIV/XV, Up.Bracklesham Beds,Whitecliff Bay (no.10).Max.diam 1200u.

Fig.17. Nummulites variolarius var.2. Lateral view, x 20. 7041 bed XVII, Up.Bracklesham Beds,Whitecliff Bay (no.1).Max.diam.1700u.

Fig.18. Nummulites variolarius var.2. Lateral view, x 20. 7041 bed XVII, Up.Bracklesham Beds,Whitecliff Bay (no.7). Max.diam.1450u.

Fgg.19. Nummulites variolarius var.2. Equatorial split, B form, x 20. 7041 bed XVII, Up.Bracklesham Beds,Whitecliff Bay.Max.diam.1950u.

Fig.20. Nummulites variolarius var.2. Equatorial split, A form, x 20. 7041 bed XVII, Up.Bracklesham Beds,Whitecliff Bay(no.16).Max.diam. 1350u.

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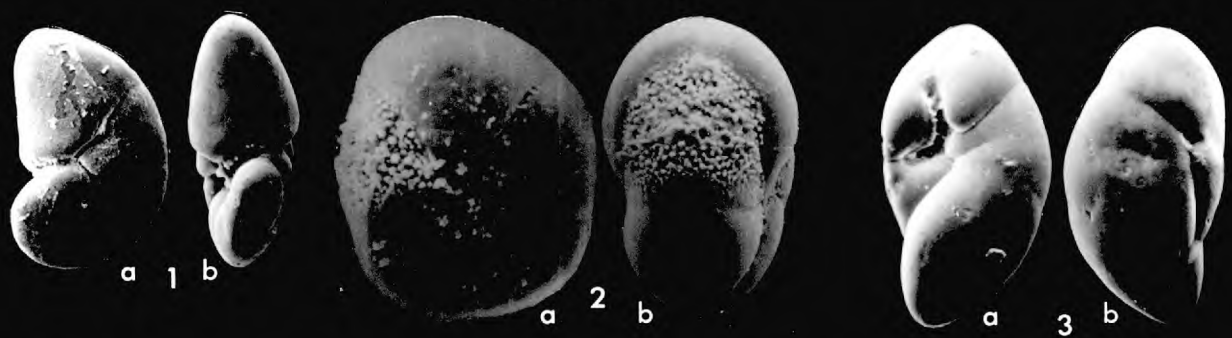
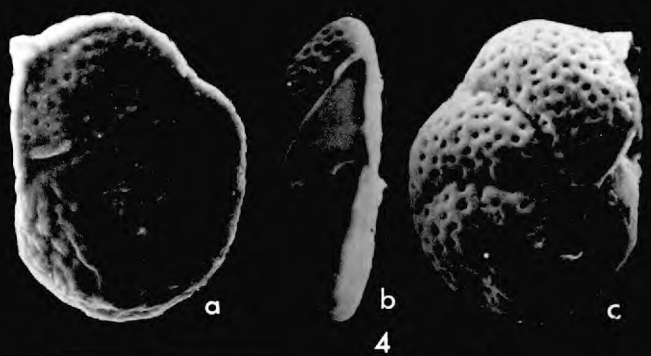
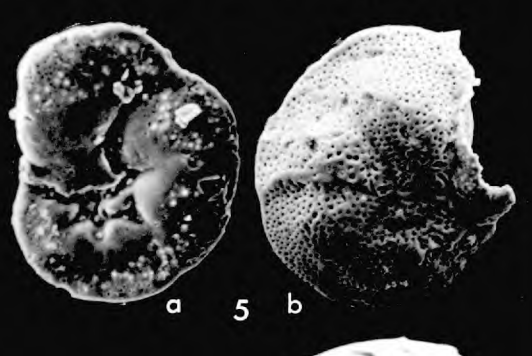
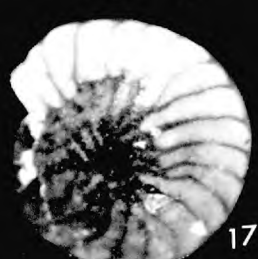
PLATE 15









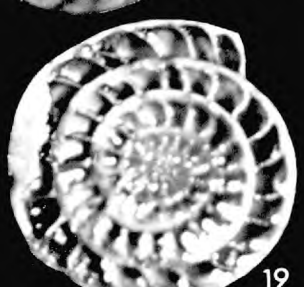


Plate 16.

Fig. 1. Nummulites sp.1. Lateral view, B form, x 20. 7170 bed H, Up. Bracklesham Beds, Fawley (no.1).Max.diam.3600u.

Fig. 2. Nummulites sp.1. Equatorial split, B form, x 20. 7170 bed H, Up. Bracklesham Beds, Fawley (no.7). Max.diam. 3300u.

Fig. 3. Nummulites sp.1. Lateral view, A form, x 20. 7170 bed H, Up. Bracklesham Beds, Fawley (no.1). Max.diam. 1800u.

Fig. 4. Nummulites sp.1. Equatorial split, A form, x 20. 7170 bed H, Up. Bracklesham Beds, Fawley (no.10). Max.diam.1900u.

Fig. 5. Nummulites sp.2. Lateral view, B form, x 20. 7175 Afton Brickyard (no.1). Max.diam.3600u.

Fig. 6. Nummulites sp.2. Lateral view, A form, x 20. 7175 Afton Brickyard (no.3). Max.diam. 1600u.

Fig. 7. Nummulites sp.2. Equatorial split, A form, x 20. 7175 Afton Brickyard (no.8). Max.diam.1700u.

Fig. 8. Nummulites sp.3. Equatorial split, A form, x 20. 7176 Huntingbridge, New Forest (no.11). Max.diam. 1600u.

Fig. 9. Nummulites sp.3. Equatorial split, B form, x 20. 7176 Huntingbridge, New Forest (no.12). Max.diam.1800u.

Fig.10. Nummulites sp.3. Lateral view, x 20. 7176 Huntingbridge, New Forest (no.3). Max.diam.1650u.

Fig.11. Nummulites sp.3. Lateral view of juvenile, x 20. 7168 Studley Wood, New Forest (no.2). Max.diam.800u.

Fig.12. Hordwellia crassisperma (CHANDLER). x 25. 6915 Barton. Length 1375u.

Fig.13. Seed sp.9. x 20. 6993 Barton. Length 950u.

Fig.14. Scirpus lakensis CHANDLER. x 25. 6886 Barton. Length 1650u.

Fig.15. Geodia sp. x 200. 7006 Barton. Max.diam.150u.

Fig.16. Crustacean chela. x 20. 6942 Barton. Length 3350u.

Fig.17. Insect Thoracic Shield. x 100. 6969 Barton. Width 350u.

Fig.18. Crustacean gastrolith. x 100. 6597 Alum Bay. Max.diam. 500u.

Fig.19. Scolescodont. x 100. 6623 Alum Bay.Length 525u.

Fig.20. Rotularia? sp.1. x 50. 6952 Barton. Max.diam. 675u.

PLATE 16

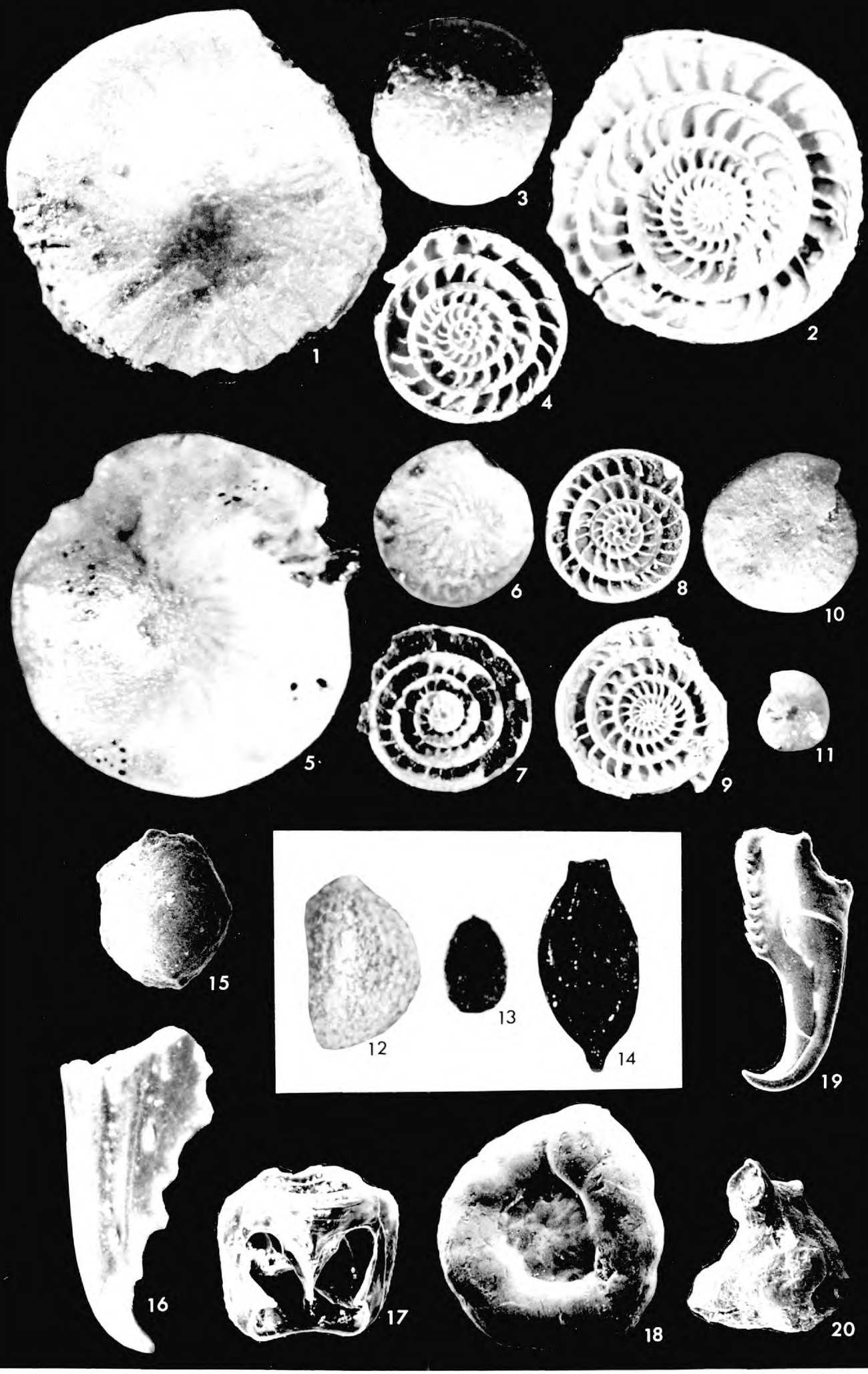


Plate 17.

Fig. 1. Bryozoa sp.11. a. Zoarial fragment, x 25. b. Detail zooecia, x 50. 6954 Barton. Length of fragment 2300u.

Fig. 2. Bryozoa sp.12. Zoarial fragment, x 50. 6963 Barton. Max.diam. fragment 975u.

Fig. 3. Bryozoa sp.6. Zoarial fragment, x 55. 6917 Barton. Max.diam. fragment 1050u.

Fig. 4. Setosellina gregoryi CHEETHAM. Detail zooecia from edge of adult colony, x 100. 6954 Barton. Diam.complete zoarium 2200u.Length central adult zooecium 275u.

Fig. 5. Nellia tenella (LAMARCK). Zoarial fragment, x 100. 6685 Alum Bay. Length fragment 750u.

Fig. 6. Lunulites transiens GREGORY. Zoarial fragment, x 50. 6671 Alum Bay. Length fragment 1400u.

Fig. 7. Lunulites transiens GREGORY. Detail two zooecia, x 100. 6671 Alum Bay. Length lower zooecium 275u.

Fig. 8. Bryozoa sp.10. Nodal zoarial fragment, x 85. 6952 Barton. Max.diam. fragment 425u.

Fig. 9. Bryozoa sp.15. Zoarial fragment, x 50. 6693 Alum Bay. Length fragment 1387u.

Fig.10. Cribrilaria cf.parisiensis (CANU). Single zooeciumwith paired avicularia, x 100. 6685 Alum Bay. Width zooecium 300u.

Fig.11. Bryozoa sp.2. Frontal wall of single zooecium, x 50. 6952 Barton. Length fragment 625u.

Fig.12. Teichopora clavata GREGORY. Zoarial fragment, x 25. 6988 Barton. Length fragment 2200u.

Fig.13. Batopora glandiformis (GREGORY). a.complete small zoarium, x 50. b. detail zooecia, x 110. 6683 Alum Bay. Length zoarium 950u.

Fig.14. Batopora glandiformis (GREGORY). Large complete spatulate zoarium, x 25. 6675 Alum Bay. Max.diam. zoarium 2150u.

Fig.15. Bryozoa sp.8. Single zooecium with hyperstomial ovicell, x 50. 6940 Barton. Length zooecium 625u.

Fig.16. Bryozoa sp.13. Two zooecia, x 100. 6600 Alum Bay.Length of lower zooecium 450u.

Fig.17. Bryozoa sp.4. Zoarial fragment with ovicell, x 50. 6689 Alum Bay. Length fragment 1900u.

Fig.18. Bryozoa? sp.7. Single zooecium, x 100. 6938 Barton. Length zooecium 300u.

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PLATE 17

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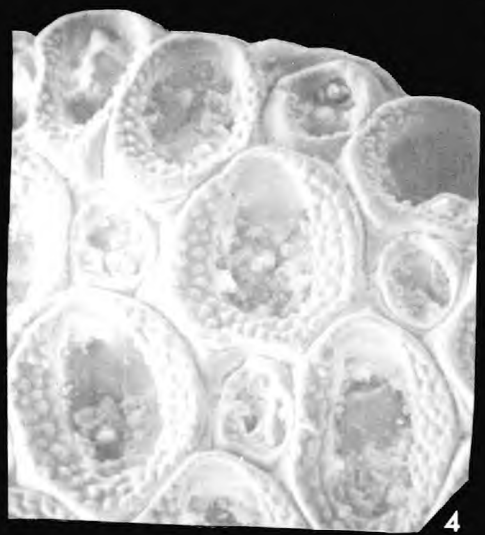
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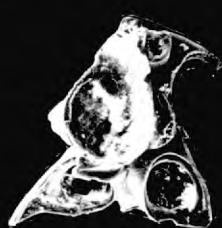
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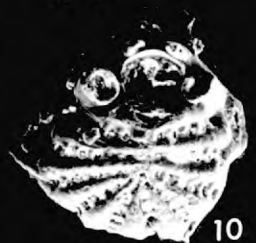
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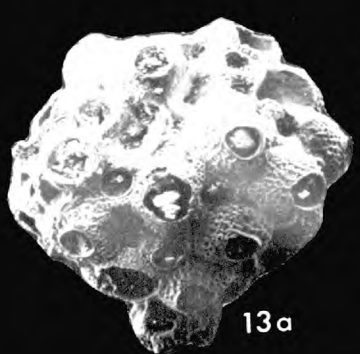
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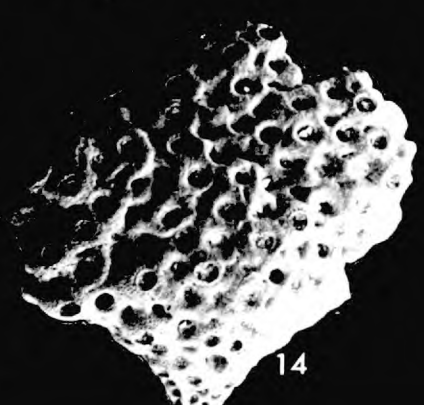
13b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18

Plate 18.

Fig. 1. Cytherella compressa (MUNSTER). a,b. External and internal views of right valve, x 100. 6948 Barton. Length 675u.

Fig. 2. Cytherella compressa (MUNSTER). a,b. Whole carapace from left and above, x 100. 6948 Barton. Length 675u.

Fig. 3. Cytherella munsteri (ROEMER). a,b. Whole carapace viewed from left and above, x 100. 6669 Alum Bay. Length 675u.

Fig. 4. Cytherella munsteri (ROEMER). Exterior left valve, x 100. 6683 Alum Bay. Length 675u.

Fig. 5. Cytherella munsteri (ROEMER). a,b. Exterior and interior views of right valve , x 100. 6683 Alum Bay. Length 725u.

Fig. 6. Cytherelloidea chewtonensis HASKINS. a,b. Exterior and interior views of left valve, x 100. 6910 Barton. Length 562u.

Fig. 7. Bairdoppilata cf. gliberti KEIJ. Whole carapace viewed from right, x 50. 6683 Alum Bay. Length 1100u.

Fig. 8. Monoceratina sp.1. a,b. Exterior and interior views of right valve, x 100. 6956 Barton. Length 512u.

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PLATE 18

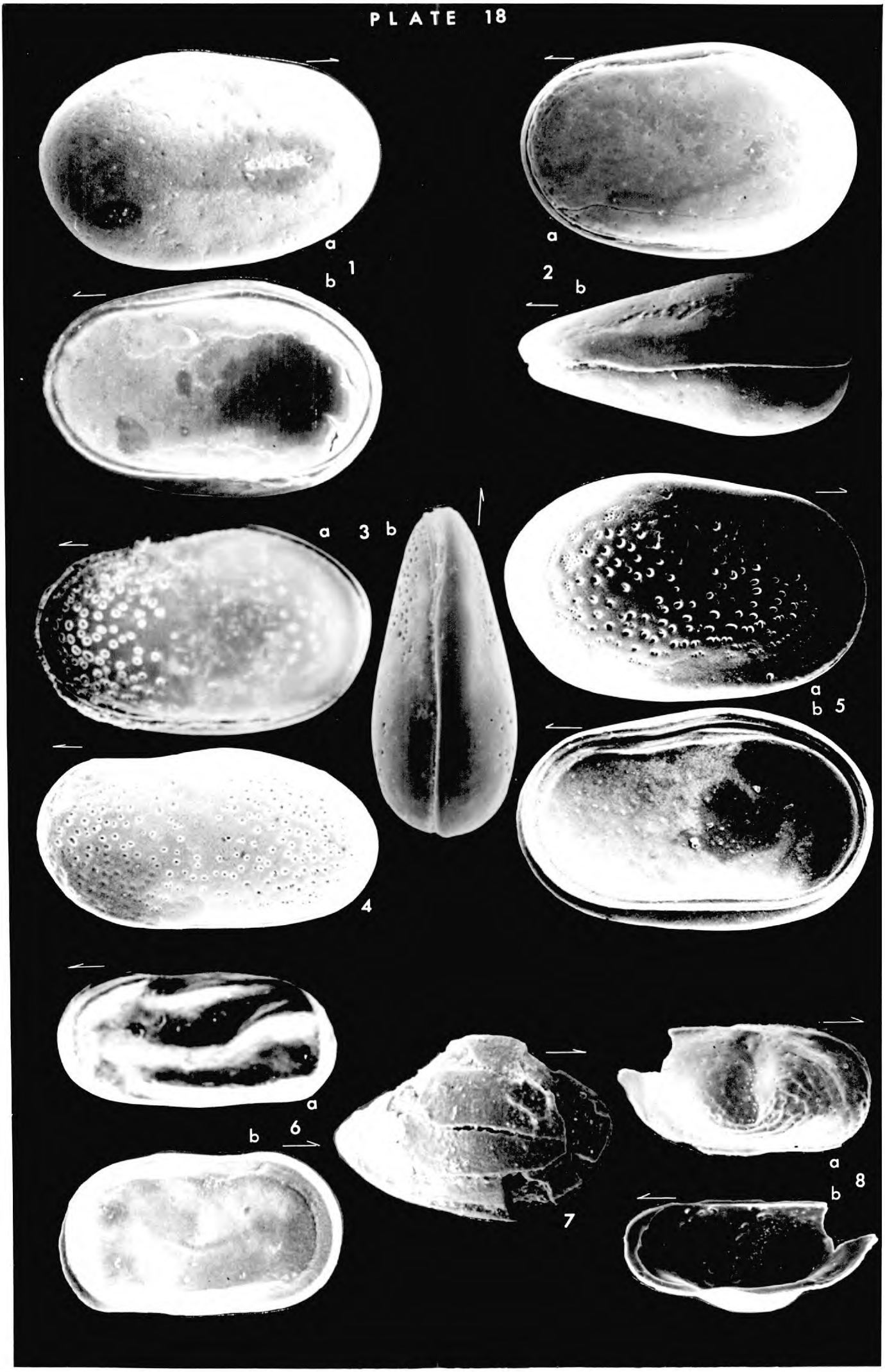

Plate 19.

Fig. 1. Paracypris contracta (JONES). a,b. Exterior and interior views of left valve, x 100. 6703 Alum Bay. Length 900u.

Fig. 2. Paracypris contracta (JONES). Whole carapace viewed from above, x 100. 6693 Alum Bay. Length 900u.

Fig. 3. Paracypris contracta (JONES). External view of right valve, x 100. 6703 Alum Bay. Length 900u.

Fig. 4. Pterygocythereis cornuta (ROEMER). a,b. External and oblique internal views of right valve, x 100. 6908 Barton. Length 800u.

Fig. 5. Pterygocythereis cornuta (ROEMER). a,b. Left valve viewed from exterior and above, x 100. 6908 Barton. Length 825u.

Fig. 6. Pterygocythereis fimbriata bartonensis KEIJ. Exterior of right valve, x 100. 6683 Alum Bay. Length 800u.

Fig. 7. Pterygocythereis fimbriata bartonensis KEIJ. Whole carapace from above, x 100. 6683 Alum Bay. Length 800u.

Fig. 8. Pterygocythereis fimbriata bartonensis KEIJ. a,b. Exterior and oblique interior views of left valve, x 100. 6683 Alum Bay. Length 825u.

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PLATE 19

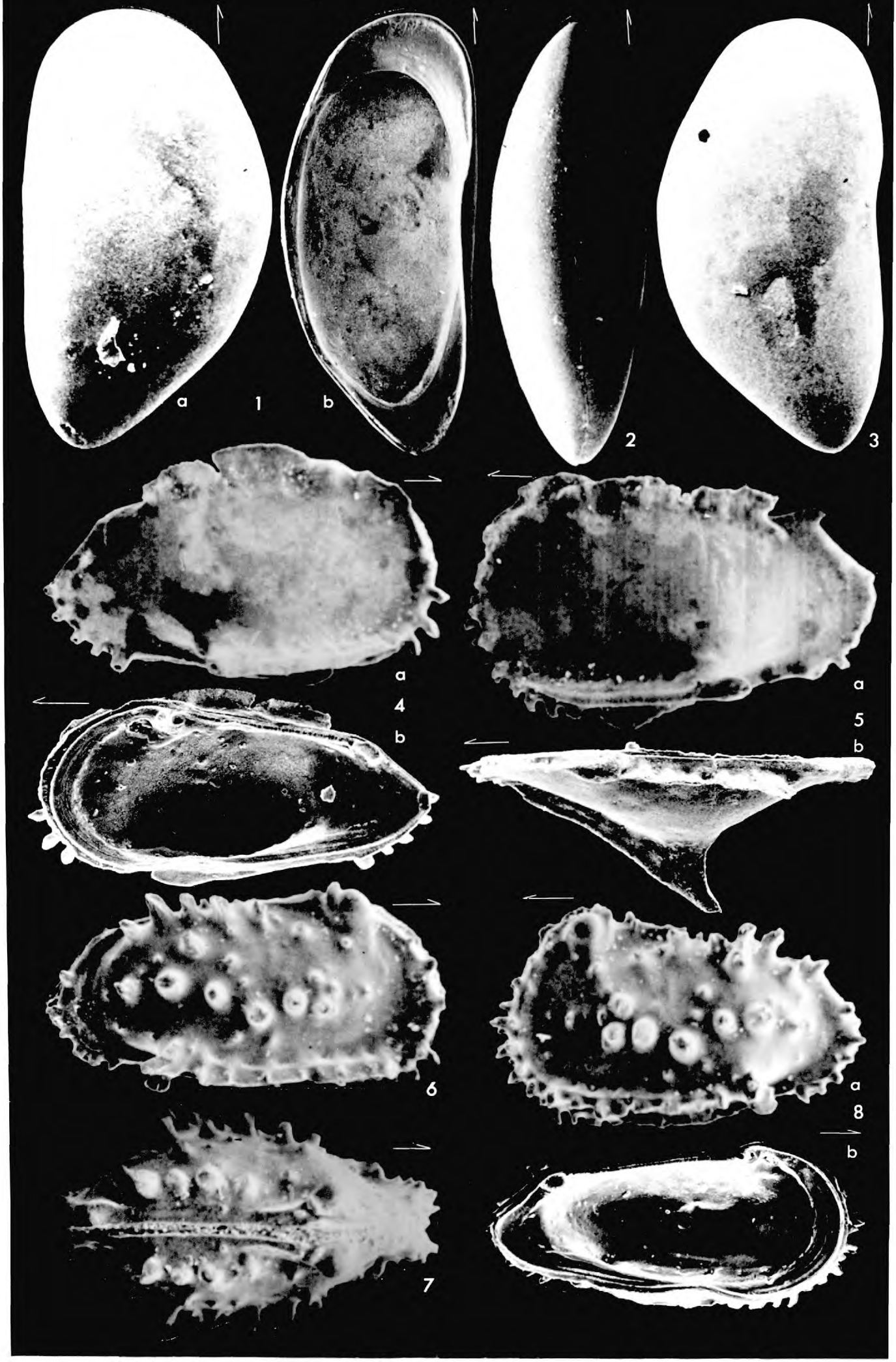

Plate 20.

Fig. 1. Pterygocythereis pustulosa HASKINS. a,b.Exterior and oblique interior views of right valve, x 100. 6685 Alum Bay. Length 850u.

Fig. 2. Pterygocythereis pustulosa HASKINS. a,b. Left valve viewed from exterior and above, x 100. 6685 Alum Bay. Length 900u.

Fig. 3. Cytheretta costellata (ROEMER). Exterior of left valve, x 100. 6671 Alum Bay. Length 750u.

Fig. 4. Cytheretta costellata (ROEMER). a,b. Exterior and interior views of right valve, x 100. 6671 Alum Bay. Length 750u.

Fig. 5. Cytheretta costellata (ROEMER). Above whole carapace, x 100. 6671 Alum Bay. Length 750u.

Fig. 6. Cytheretta gracilicosta (REUSS). Above whole carapace, x 100. 6673 Alum Bay. Length 550u.

Fig. 7. Cytheretta gracilicosta (REUSS). a,b. Interior and exterior views of right valve, x 100. 6673 Alum Bay. Length 525u.

Fig. 8. Cytheretta gracilicosta (REUSS). a,b. Interior and exterior views of left valve, x 100. 6673 Alum Bay. Length 525u.

Fig. 9. Cytheretta sp.9. a,b. Exterior and interior views of right valve, x 100. 6671 Alum Bay. Length 725u.

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PLATE 20

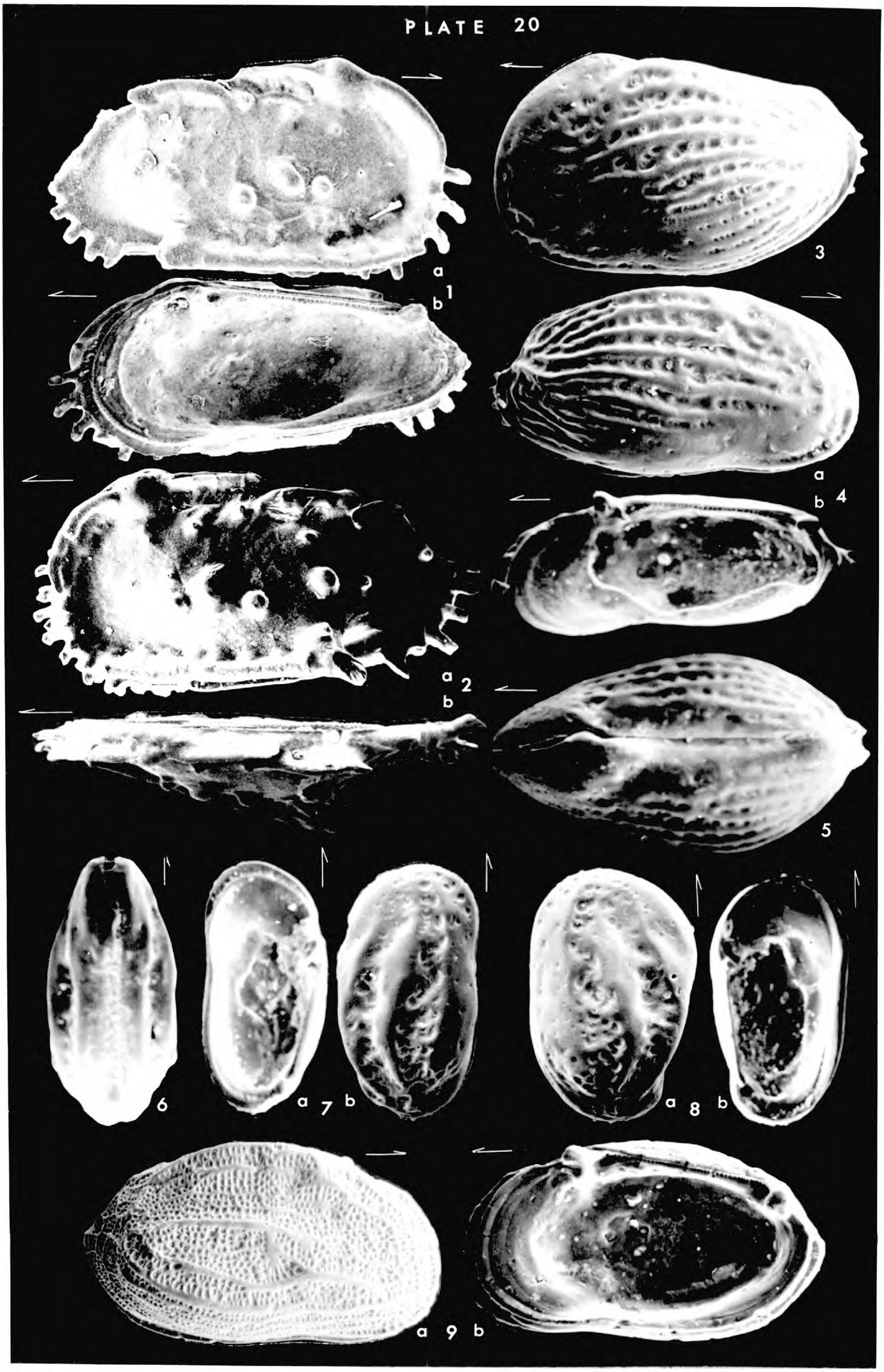

Plate 21.

Fig. 1. Cytheretta laticosta (REUSS). a,b. External and internal views of right valve, x 100. 6604 Alum Bay. Length 900u.

Fig. 2. Cytheretta laticosta (REUSS). a,b. External and internal views of left valve, x 100. 6604 Alum Bay. Length 850u.

Fig. 3. Cytheretta laticosta (REUSS). Above whole carapace, x 100. 6604 Alum Bay. Length 850u.

Fig. 4. Cytheretta minor (LIENENKLAUS). Above whole carapace, x 100. 6687 Alum Bay. Length 750u.

Fig. 6. Cytheretta minor (LIENENKLAUS). a,b. Exterior and interior views of left valve, x 100. 6646 Alum Bay. Length 775u.

Fig. 6. Krithe bartonensis (JONES). a,b. Exterior and interior views of left valve, x 100. 6685 Alum Bay. Length 600u.

Fig. 7. Krithe bartonensis (JONES). Above whole carapace, x 100. 6685 Alum Bay. Length 625u.

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PLATE 21

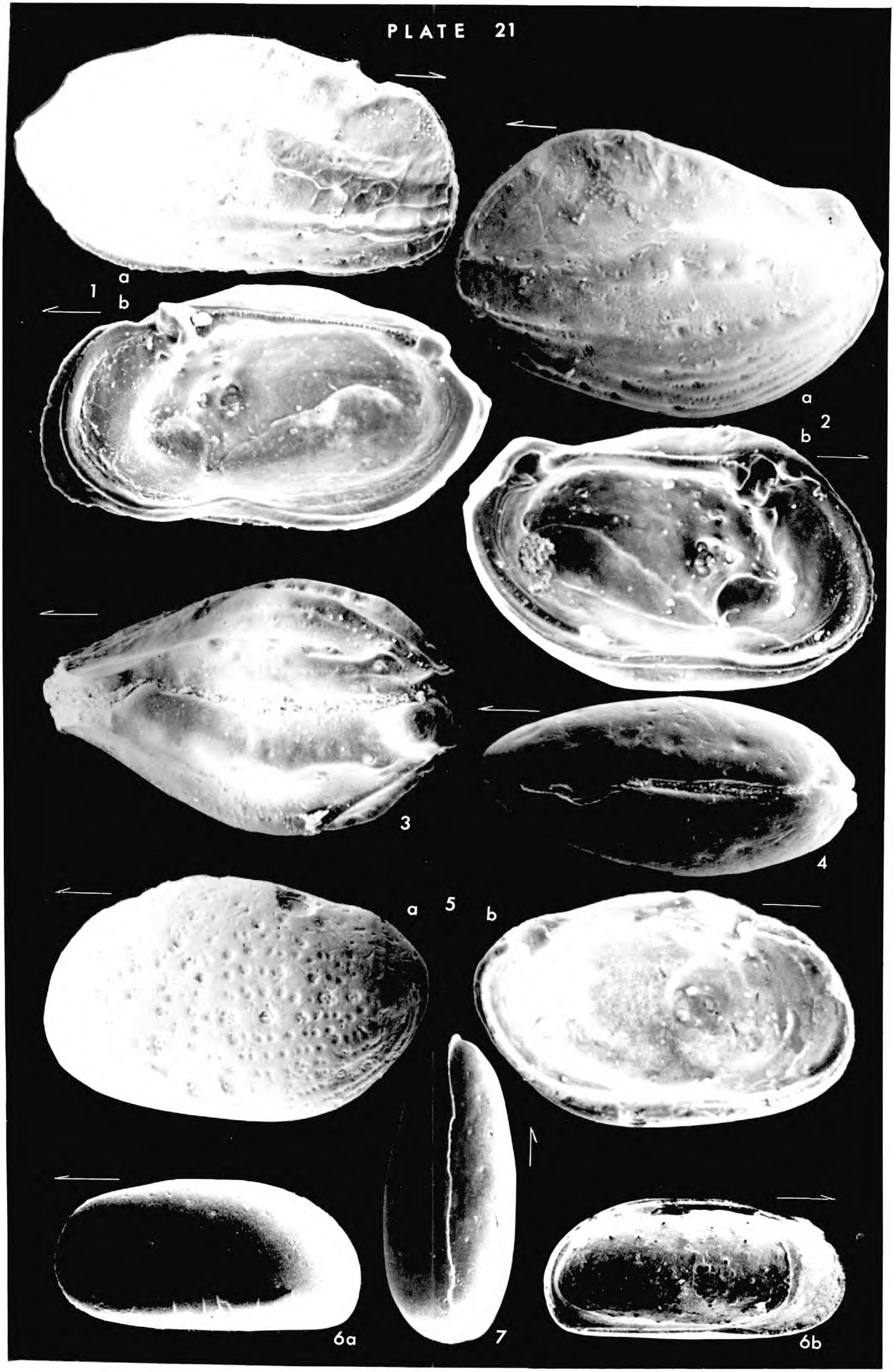

Plate 22.

Fig. 1. Cytheridea (C.) intermedia (REUSS). Exterior right valve, x 100. 6669 Alum Bay. Length 750u.

Fig. 2. Cytheridea (C.) intermedia (REUSS). Exterior left valve, x 100. 6669 Alum Bay. Length 775u.

Fig. 3. Cytheridea (C.) intermedia (REUSS). Interior right valve, x 100. 6604 Alum Bay.Length 775u.

Fig. 4. Cytheridea (C.) intermedia (REUSS). Interior left valve, x 100. 6604 Alum Bay. Length 750u.

Fig. 5. Cytheridea (C.) intermedia (REUSS). Above whole carapace, x 100. 6604 Alum Bay. Length 800u.

Fig. 6. Cyamocytheridea hebertiana (BOSQUET) a,b. External and internal views of left valve, x 100. 6685 Alum Bay. Length 650u.

Fig. 7. Cyamocytheridea hebertiana (BOSQUET). Above whole carapace, x 100. 6676 Alum Bay. Length 575u.

Fig. 8. Schuleridea (A.) perforata (ROEMER). Exterior left valve, x 100. 6669 Alum Bay. Length 800u.

Fig. 9. Schuleridea (A.) perforata (ROEMER). Above whole carapace, x 100. 6669 Alum Bay. Length 775u.

Fig.10. Schuleridea (A.) perforata (ROEMER). a,b. Exterior and interior views of right valve, x 100. 6669 Alum Bay. Length 800u.

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PLATE 22

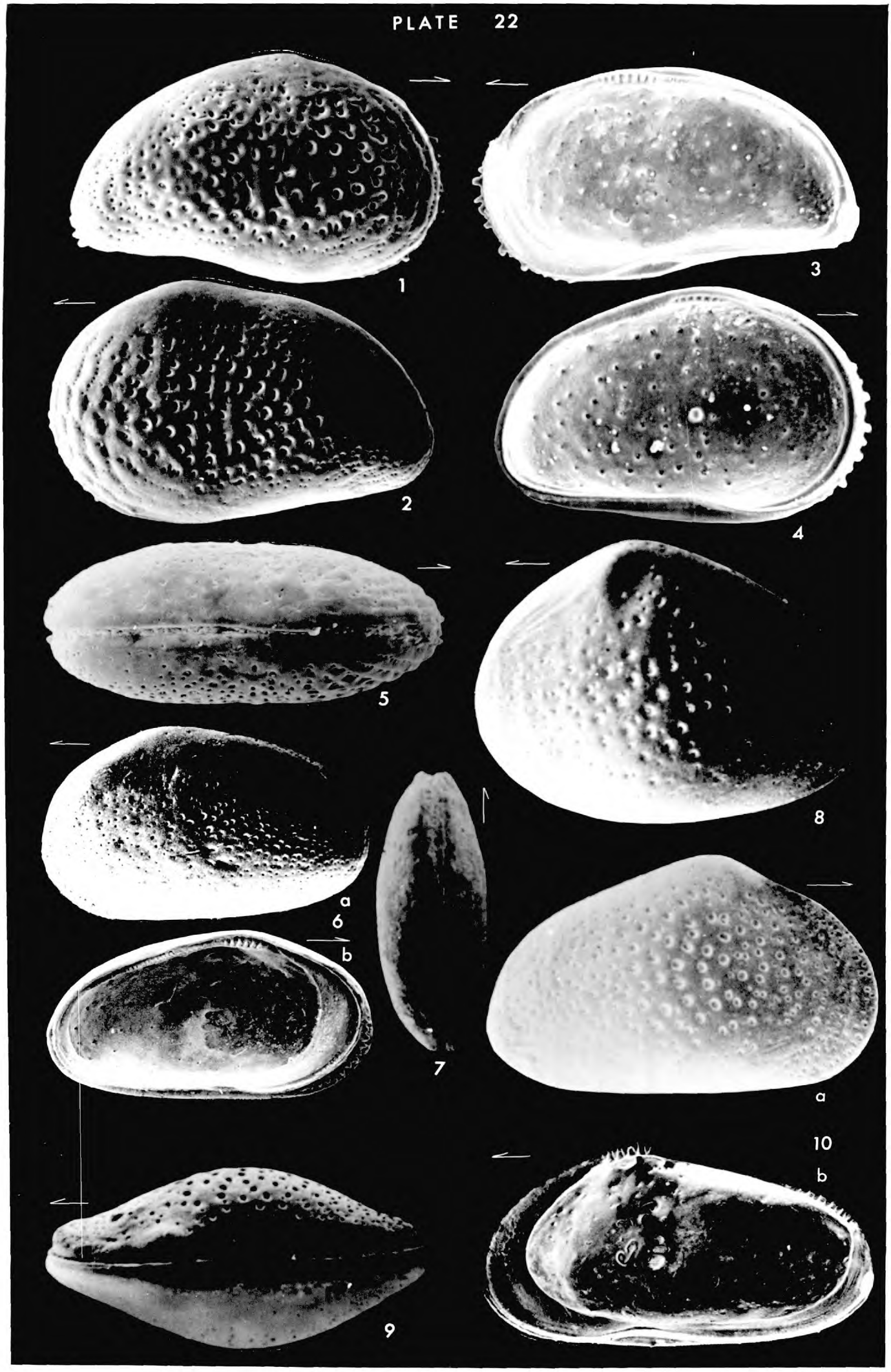

Plate 23.

Fig. 1. Cuneocythere (M.) triebeli KEIJ. a,b. Exterior and interior views of left valve, x 100. 6689 Alum Bay. Length 500u.

Fig. 2. Cuneocythere (M.) triebeli KEIJ. Above whole carapace, x 100. 6950 Barton. Length 475u.

Fig. 3. Cuneocythere (M.) triebeli KEIJ. Exterior right valve, x 100. 6689 Alum Bay. Length 475u.

Fig. 4. "Cytherura" cf. bambruggensis KEIJ. a,b.Exterior and interior views of right valve, x 100. 6946 Barton. Length 300u.

Fig. 5. "Cytherura" cf. bambruggensis KEIJ. Exterior left valve, x 100. 6591 Alum Bay. Length 325u.

Fig. 6. Eucytherura cf. perforatina EAGAR. a,b. Exterior and interior views of left valve, x 100. 6586 Alum Bay. Length 300u.

Fig. 7. Eucytherura cf. perforatina EAGAR. Above whole carapace, x 100. 6586 Alum Bay. Length 300u.

Fig. 8. Cytheropteron wetherelli (JONES). a,b. Exterior and oblique interior views of rightvalve, x 100. 6604 Alum Bay. Length 775u.

Fig. 9. Cytheropteron wetherelli (JONES). a,b. Exterior and dorsal views of left valve, x 100. c. Detail surface reticulation and pores, about x 1000. d. Detail single sieve pore (left central in 9c), about x 6000. 6604 Alum Bay. Length 700u.

Fig.10. Cytheropteron brimptoni BOWEN. a,b. Whole carapace viewed from left and above, x 100. 6935 Barton. Length 350u.

Fig.11. Paracytheridea gradata (BOSQUET). a,b. Exterior and interior views of right valve, x 100. 6600 Alum Bay. Length 425u.

Fig.12. Loxoconcha subovata (MUNSTER). a,b. Exterior and interior views of left valve, x 100. 6964 Barton. Length 350u.

Fig. 13. Loxoconcha subovata (MUNSTER). Above whole carapace, x 100. 6946 Barton. Length 350u.

Fig.14. Loxoconcha subovata (MUNSTER). a,b. Exterior and interior views of right valve, x 100. 6597 Alum Bay. Length 475u.

Fig.15. Cytheromorpha brabantica KEIJ. Exterior right valve, x 100. 6689 Alum Bay.Length 425u.

Fig.16. Cytheromorpha brabantica KEIJ. Above whole carapace, x 100. 6604 Alum Bay. Length 387u.

Fig.17. Cytheromorpha brabantica KEIJ. Exterior left valve, x 100. 6689 Alum Bay. Length 425u.

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PLATE 23

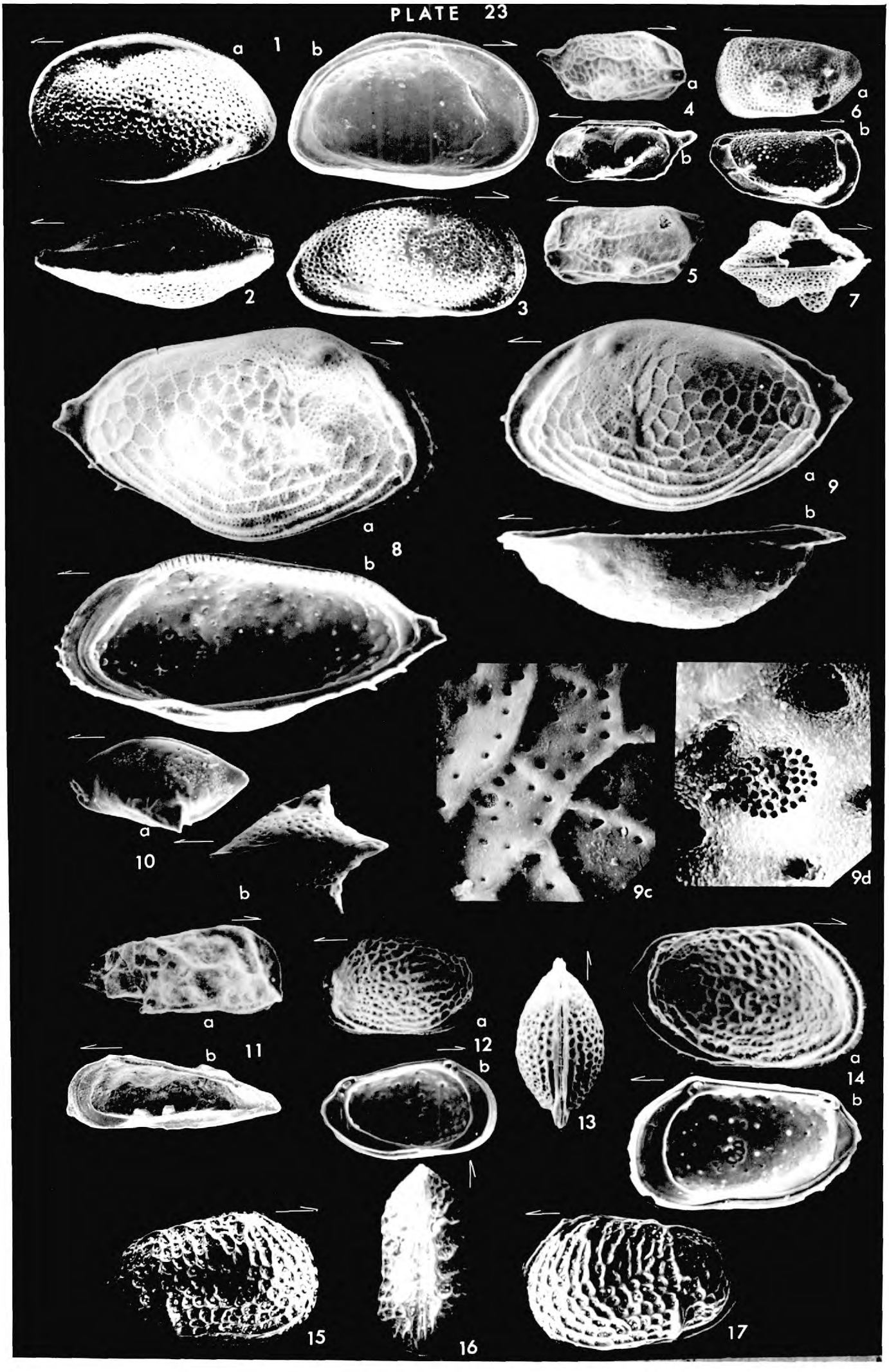

Plate 24.

Fig. 1. Leguminocythereis striatopunctata (ROEMER). a,b. Exterior and interior views of right valve, x 100. 6669 Alum Bay. Length 975u.

Fig. 2. Leguminocythereis striatopunctata (ROEMER). a,b. Exterior and dorsal views of left valve, x 100. 6669 Alum Bay. Length 1050u.

Fig. 3. Schizocythere batjezi KEIJ. a,b. Exterior and interior views of right valve, x 100. 6679 Alum Bay. Length 450u.

Fig. 4. Schizocythere batjezi KEIJ. a,b. Exterior and dorsal views of left valve, x 100. 6679 Alum Bay. Length 450u.

Fig. 5. Paijenborchella eocenica TRIEBEL. Above whole carapace, x 100. 6683 Alum Bay. Length 525u.

Fig. 6. Paijenborchella eocenica TRIEBEL. a,b. Exterior and interior views if right valve, x 100. 6683 Alum Bay. Length 500u.

Fig. 7. Paijenborchella eocenica TRIEBEL. Exterior left valve, x 100. 6683 Alum Bay. Length 500u.

Fig. 8. Occultocythereis sp.1. Oblique dorsal view of whole carapace, x 100. 6685 Alum Bay. Length 475u.

Fig. 9. Occultocythereis sp.1. a,b. Interior and exterior views of left valve, x 100. 6685 Alum Bay. Length 487u.

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PLATE 24

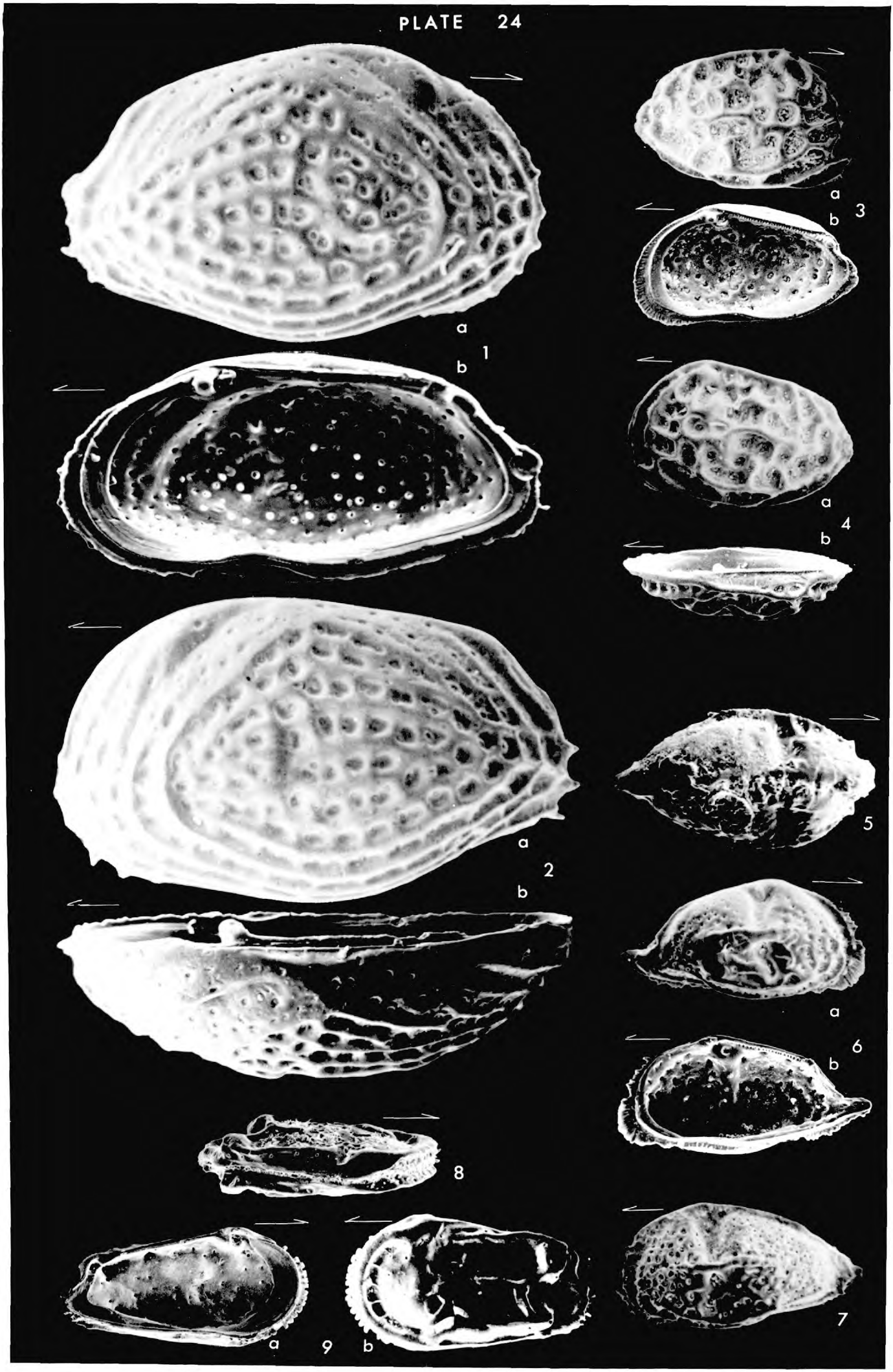

Plate 25.

Fig. 1. Trachyleberis (T.) aculeata (BOSQUET). Exterior right valve, x 100. 6669 Alum Bay. Length 900u.

Fig. 2. Trachyleberis (T.) aculeata (BOSQUET). a,b. Exterior and oblique interior views of left valve, x 100. 6669 Alum Bay. Length 850u.

Fig. 3. Trachyleberis (T.) aculeata (BOSQUET). Above whole carapace, x 100. 6669 Alum Bay. Length 950u.

Fig. 4. Quadracythere? sp.1. a,b. Exterior and interior views of right valve, x 100. 6937 Barton. Length 400u.

Fig. 5. Quadracythere? sp.1. a,b. Dorsal and exterior views of left valve, x 100. 6937 Barton. Length 400u.

Fig. 6. Quadracythere sp.2. a,b. Exterior and interior views of left valve, x 100. 6600 Alum Bay. Length 500u.

Fig. 7. Quadracythere sp.2. Above whole carapace, x 100. 6590 Alum Bay. Length 550u.

Fig. 8. Quadracythere sp.2. a,b. Exterior and interior views of right valve, x 100. 6600 Alum Bay. Length 500u.

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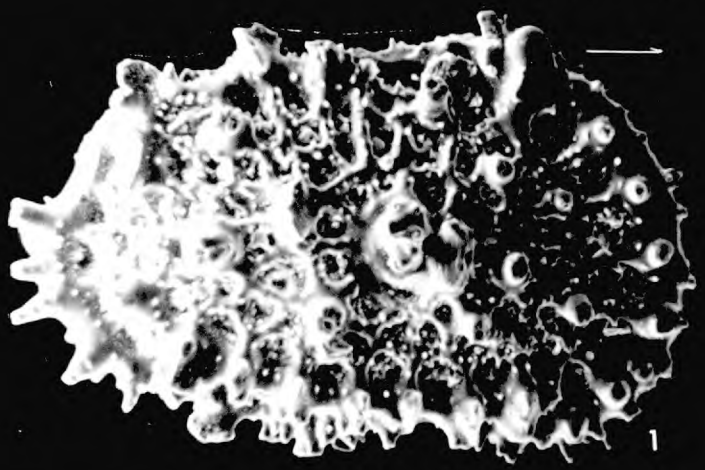
PLATE 25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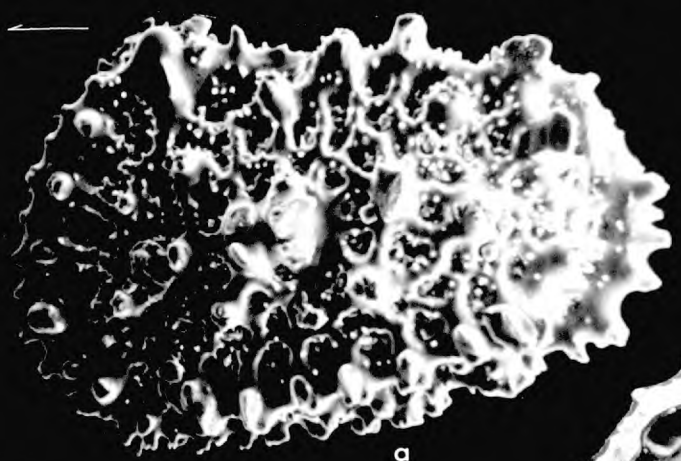
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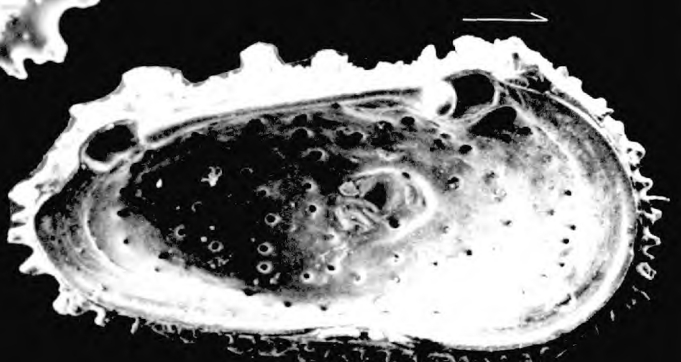

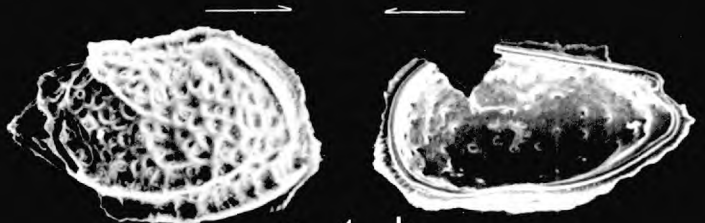
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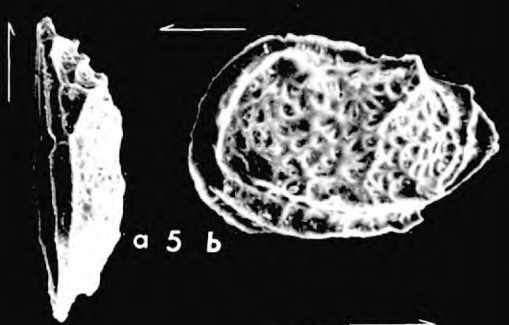
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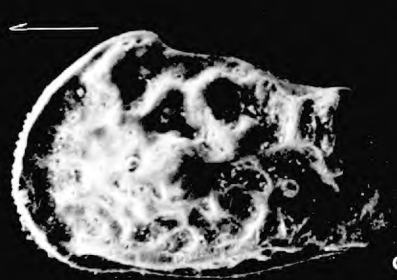
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a 8 b

Plate 26.

Fig. 1. Bosquetina sp.1. a,b. Exterior and interior views of male right valve, x 100. 6590 Alum Bay. Length 1075u.

Fig. 2. Bosquetina sp.1. Above whole carapace of female, x 100. 6590 Alum Bay. Length 875u.

Fig. 3. Bosquetina sp.1. Exterior view female left valve, x 100. 6590 Alum Bay. Length 950u.

Fig. 4. Myrtaea spinulosa (LOWRY). Exterior left valve, x 10. 6638 Alum Bay. Max.diam. 3150u.

Fig. 5. Myrtaea spinulosa (LOWRY). Interior left valve, x 10. 6638 Alum Bay. Max.diam. 2250u.

Fig. 6. Erycina sp.1. Exterior left valve, x 20. 6679 Alum Bay. Length 2150u.

Fig. 7. Erycina sp.1. Interior fragment, x 20. 6676 Alum Bay. Length 1050u.

Fig. 8. Erycina? sp.2. Exterior articulated specimen, x 20. 6596 Alum Bay. Length 1450u.

Fig. 9. Erycina? sp.3. Exterior right valve, x 20. 6669 Alum Bay. Length 750u.

Fig.10. Erycina? sp.3. Interior fragmentary left valve, x 20. 6669 Alum Bay. Length 600u.

Fig.11. Abra sp.1. a,b. Exterior and interior views of broken right valve, x 20. 6596 Alum Bay. Length 1600u.

Fig.12. Psammobia? sp.1. Exterior, x 20. 6948 Barton. Length 1350u.

Fig.13. Cardium? sp.1. Interior, x 20. 6934 Barton. Length 1600u.

Fig.14. Pteria? sp.1. Exterior right valve, x 20. 6586 Alum Bay. Length 850u.

Fig.15. Pteria? sp.2. Exterior right valve, x 20. 6600 Alum Bay. Length 1000u.

Fig.16. Anomia sp.2. Interior left valve, x 20. 6950 Barton. Length 1450u.

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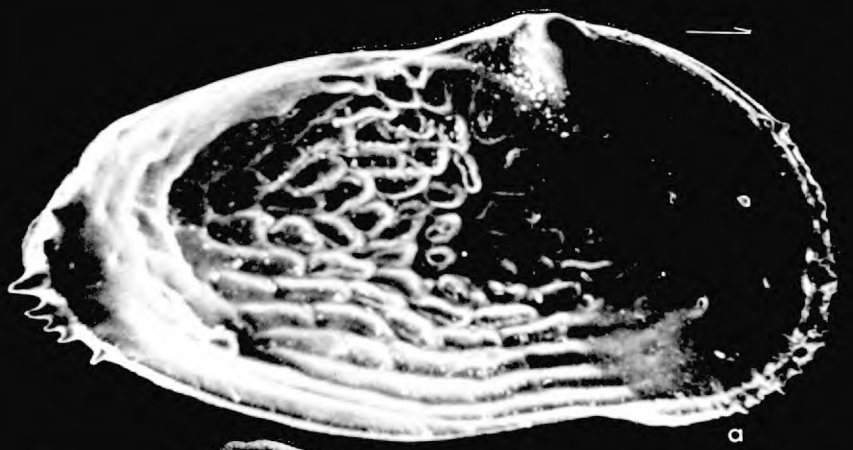
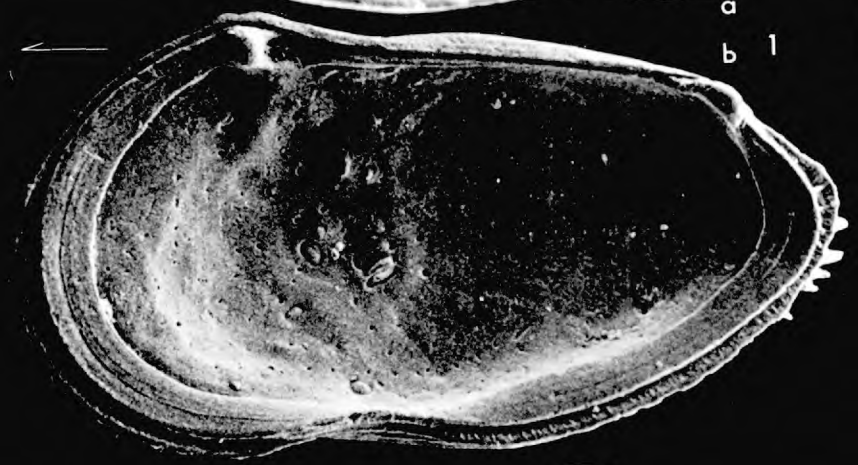
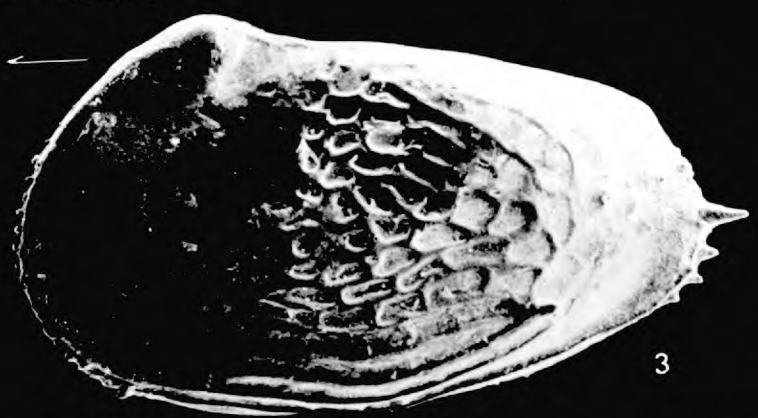
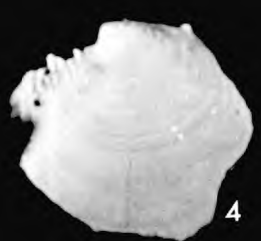
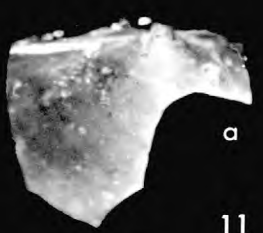
PLATE 26

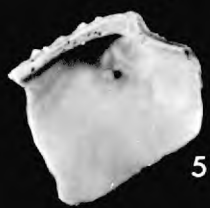












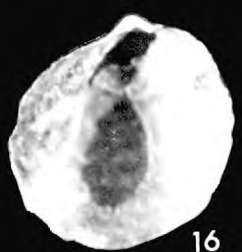


Plate 27.

Fig. 1. Solen sp.1. a,b. External and internal views of left valve, x 10. 6964 Barton. Length 7550u.

Fig. 2. Meretricid Juvenile Type 1. Exterior left valve, x 20. 6683 Alum Bay. Length 1200u.

Fig. 3. Meretricid Juvenile Type 1. Exterior right valve, x 20. 6683 Alum Bay. Length 1300u.

Fig. 4. Meretricid Juvenile Type 1. Interior right valve, x 20. 6948 Barton. Length 1700u.

Fig. 5. Meretricid Juvenile Type 2. Exterior left valve, x 10. 6926 Barton. Length 3800u.

Fig. 6. Meretrix sp.3. Left view of articulated specimen, x 10. 6941 Barton. Length 5200u.

Fig. 7. Lentidium sp.1. a,b. Exterior and interior views of right valve, x 20. 6949 Barton. Length2150u.

Fig. 8. Adeorbis sp.7. x 20. 6959 Barton. Max.diam. 1150u.

Fig. 9. Adeorbis sp.8. x 20. 6963 Barton. Max.diam. 850u.

Fig.10. Odostomia hordeola (LAMARCK). Adult, x 20. 6595 Alum Bay.Length 2000.

Fig.11. Odostomia hordeola (LAMARCK). Juvenile, x 20. 6683 Alum Bay. Length 1350u.

Fig.12. Odostomia miliola (LAMARCK). x 20. 6671 Alum Bay. Length 2400u.

Fig.13. Odostomia sp.1. x 20. 6954 Barton. Length 1150u.

Fig.14. Odostomia sp.2. x 20. 6963 Barton. Length 1450u.

Fig.15. Odostomia sp.3. x 20. 6939 Barton. Length 1850u.

Fig.16. Odostomia sp.4. x 20. 6964 Barton. Length 2800u.

Fig.17. Odostomia sp.7. x 20. 6591 Alum Bay. Length 2100u.

Fig.18. Odostomia sp.8. x 20. 6642 Alum Bay. Length 2100u.

Fig.19. Syrnola canaliculata (EDWARDS m.s.). x 20. 6695 Alum Bay. Length 1050u.

Fig.20. Syrnola excavata (EDWARDS m.s.). x 20. 6681 Alum Bay. Length 1650u.

Fig.21. Syrnola excavata var.1. x 20. 6928 Barton. Length 2250u.

Fig.22. Syrnola polygyra (EDWARDS m.s.) x 20. 6676 Alum Bay. Length 1300u.

Fig.23. Anisocycla sp.11. Juvenile,x 50. 6948 Barton. Length 450u.

Fig.24. Anisocycla sp.11. Adult, x 50. 6944 Barton. Length 800u.

Plate 27 (cont.)

Fig. 25. Belonidium eulimoides (EDWARDS m.s.). x 20. 6595 Alum Bay. Length 1300u.

Fig. 26. Turbonilla pulchra DESHAYES. x 20. 6597 Alum Bay. Length 1500u.

Fig. 27. Turbonilla edwardsi GLIBERT. x 10. 6935 Barton. Length 4350u.

Fig. 28. Eulima sp.1. x 20. 6685 Alum Bay. Length 1700u.

Fig. 29. Eulima sp.2. x 20. 6907 Barton. Length 1300u.

Fig. 30. Acrilla sp.1. x 20. 6629 Alum Bay. Length 2450u.

Fig. 31. Lacuna (Epheria) sp.1. x 20. 6963 Barton. Length 1300u.

Fig. 32. Rissoa globulus EDWARDS (m.s.).x 20. 6586 Alum Bay. Length 950u.

Fig. 33. Rissoa sp.1. x 20. 6951 Barton. Length 1600u.

Fig. 34. Alvania sp.3. x 20. 6604 Alum Bay. Length 2200u.

Fig. 35. Bithinia? sp.1. x 20. 6699 Alum Bay. Length 1400u.

Fig. 36. Xenophora sp.1. x 20. 6675 Alum Bay. Diam.2050u.

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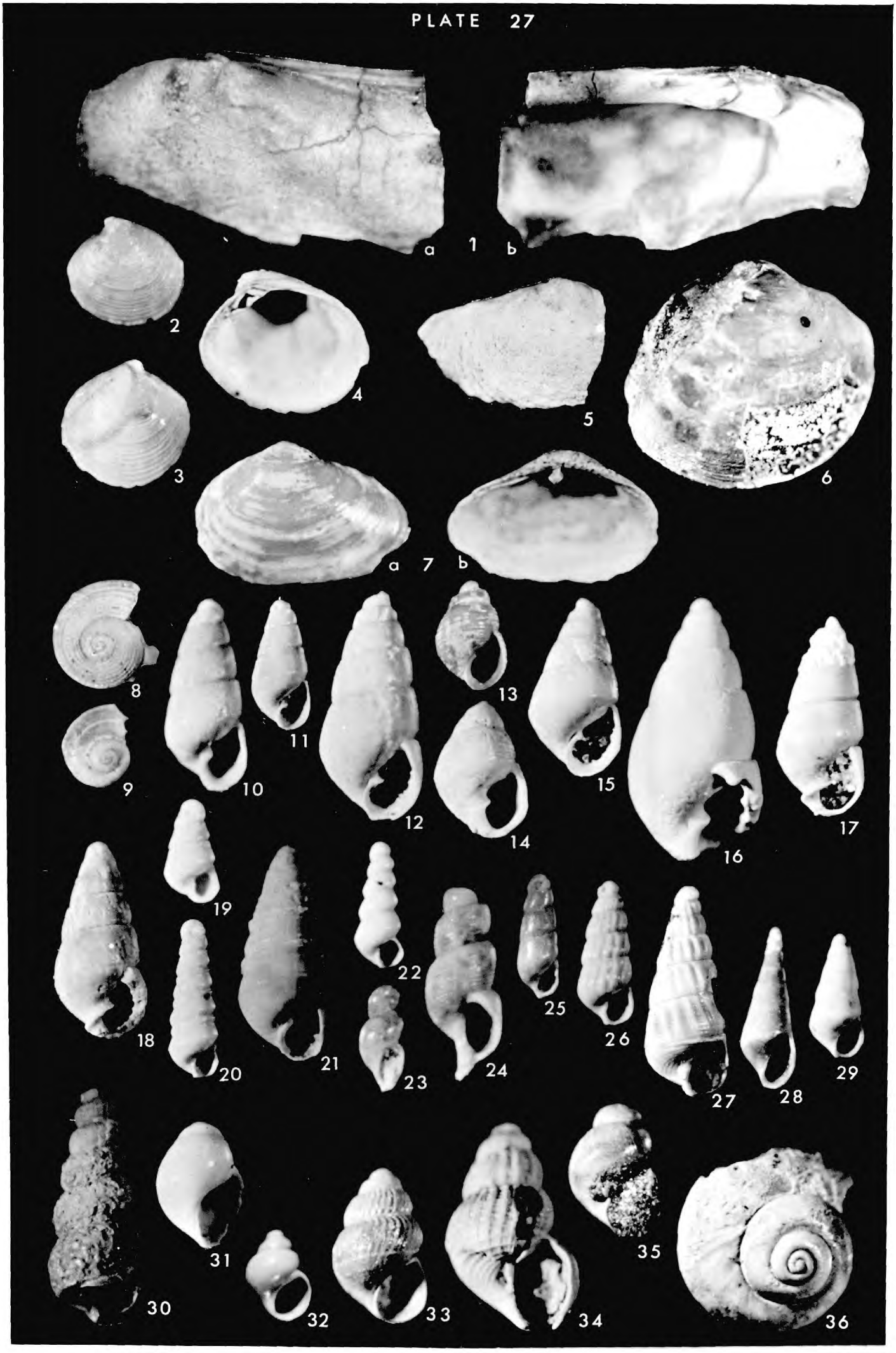
PLATE 27
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Plate 28.

Fig. 1. Architectonica sp.1. Juvenile, x 20. 6681 Alum Bay. Diam.4100u.

Fig. 2. Architectonica sp.1. Initial stage, x 20. 6695 Alum Bay. Diam.1200u.

Fig. 3. Capulus sp.2. x 20. 6702 Alum Bay. Max.diam.2100u.

Fig. 4. Strebloceras cornuoides CARPENTER. Typical form, x 20.6689 Alum Bay. Length 600u.

Fig. 5. Strebloceras cornuoides CARPENTER. Elongate form, x 20. 6693 Alum Bay. Length 1100u.

Fig. 6. Thecopsella sp.1. x 20. 6602 Alum Bay. Length 850u.

Fig. 7. Berthelinia cf.elegans CROSSE. x 50. 6628 Alum Bay. Max.diam.650u.

Fig. 8. Mesalia sp.4. x 20. 6627 Alum Bay. Length 3900u.

Fig. 9. Aneurychilus sp.1. x 20. 6939 Barton. Length 2100u.

Fig.10. Bittium sp.2. x 20. 6599 Alum Bay. Length 1400u.

Fig.11. Bittium sp.3. x 20. 6587 Alum Bay. Length 1500u.

Fig.12. Bittium sp.5. x 20. 6963 Barton. Length 1550u.

Fig.13. Triforis? sp.1. x 50. 6917 Barton. Length 750u.

Fig.14. Ancilla sp.1. x 20. 6956 Barton. Length 2600u.

Fig.15. Eopleurotoma? sp.1. x 20. 6689 Alum Bay. Length 2350u.

Fig.16. Surcula sp.4. x 10. 6945 Barton. Length 4500u.

Fig.17. Turrid sp.3. x 10. 6617 Alum Bay. Length 3600u.

Fig.18. Turrid sp.4. x 20. 6591 Alum Bay. Length 1400u.

Fig.19. Turrid sp.10. x 10. 6953 Barton. Length 3600u.

Fig.20. Turrid sp.11. x 10. 6935 Barton. Length 4550u.

Fig.21. Turrid sp.14. x 10. 6955 Barton. Length 4050u.

Fig.22. Turrid sp.15. x 10. 6683 Alum Bay. Length 4400u.

Fig.23. Turrid sp.17. x 10. 6943 Barton. Length 4200u.

Fig.24. Turrid sp.18. x 10. 6962 Barton. Length 3950u.

Fig.25. Turrid sp.20. x 10. 6677 Alum Bay. Max.diam.3300u.

Fig.26. Turrid sp.21. x 10. 6673 Alum Bay. Length 2200u.

Fig.27. Scaphander? sp.1. x 20. 6675 Alum Bay. Width 1150u.

Fig.28. Bullinella sp.3. x 20. 6907 Barton. Length 900u.

Fig.29. Bullinella sp.5. x 20. 6981 Barton. Length 2100u.

Fig.30. Gastropod gen. H.sp.1. x 10. 6940 Barton. Max.diam. 4650u.

Fig.31. Nautiloid Siphuncle? x 20. 6938 Barton. Length 2150u.

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PLATE 28

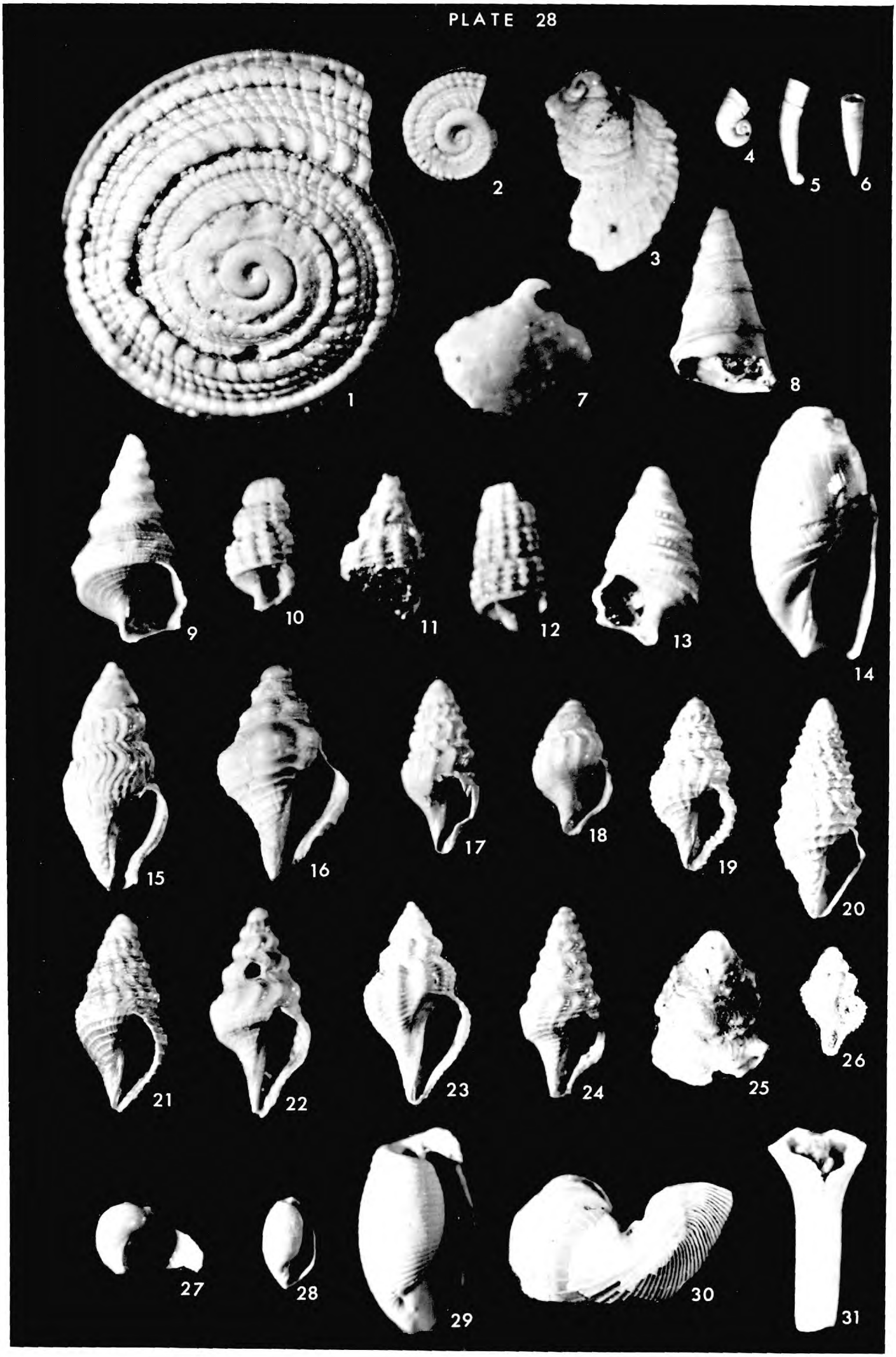
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Plate 29.

Fig. 1. Asteroid marginal type 23. Elongate form, x 20. 6673 Alum Bay. Length 3700u.

Fig. 2. Asteroid marginal type 23. a,b. Lateral and peripheral views of equitant form, x 20. 6679 Alum Bay. Length 1850u.

Fig. 3. Asteroid ambulacral ossicle type 26. x 50. 6600 Alum Bay. Length 1050u.

Fig. 4. Asteroid terminal ossicle type 29. x 50. 6957 Barton. Length 500u.

Fig. 5. Asteroid? ossicle type 22. x 50. 6685 Alum Bay. Length 1050u.

Fig. 6. Asteroid paxilla type 24. x 50. 6695. Alum Bay. Length 625u.

Fig. 7. Asteroid paxilla type 45. x 20. 6590 Alum Bay. Width 1000u.

Fig. 8. Asteroid? ossicle type 36. x 80. 6910 Barton. Length 500u.

Fig. 9. Echinoid spine type 44. x 20. 6685 Alum Bay. Length 6900u.

Fig.10. Echinoid spine type 2. x 30. 6586 Alum Bay. Length 1750u.

Fig.11. Echinoid spine type 4. x 30. 6597 Alum Bay. Length 1425u.

Fig.12. Echinoid spine type 6. x 20. 6617 Alum Bay. Length 1450u.

Fig.13. Echinoid spine type 37. 20. 6930 Barton. Length 1125u.

Fig.14. Echinoid interambulacral plate type 35. Attached to series of ambulacral plates,x20. 6681 Alum Bay. Max.diam.3600u.

Fig.15. Echinoid interambulacral plate type 35. Smaller specimen, x20. 6681 Alum Bay. Max.diam.2200u.

Fig.16. Echinoid ambulacral plate type 38. x 40. 6934 Barton.Max.diam. [illegible]u.

Fig.17. Crinoid brachial type 46. x20. 6695 Alum Bay. Length 1150u.

Fig.18. Crinoid facetal? type 33. x50. 6898 Barton.Length 975u.

Fig.19. Ophiuroid vertebral ossicle type 13. Dorsal view, x 80. 6595 Alum Bay. Length 425u.

Fig.20. Ophiuroid vertebral ossicle type 13. Anterior of braoder form, x 50. 6600 Alum Bay. Width 1037u.

Fig.21. Ophiuroid disc ossicle? type 41. x 50. 6699 Alum Bay.Max.diam. 1325u.

Fig.22. Ophiuroid genital plate; type 42. x50. 6956 Barton.Length 1025u.

Fig.23. Ophiuroid jaw ossicle? type16.x50. 6946 Barton. Length 950u.

Fig.24. Ophiuroid ventral arm plate type 40.x80. 6957 Barton.Length 450u.

Fig.25. Ophiuroid dorsal arm plate type 39.x50. 6951 Barton. Width 587u.

Fig.26. Ophiuroid lateral arm plate type 1.x50. 6681 Alum Bay.Length 575u.

Fig.27. Ophiuroid lateral arm plate type 1. x 80. 6681 Alum Bay. Length 567u.

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PLATE 29

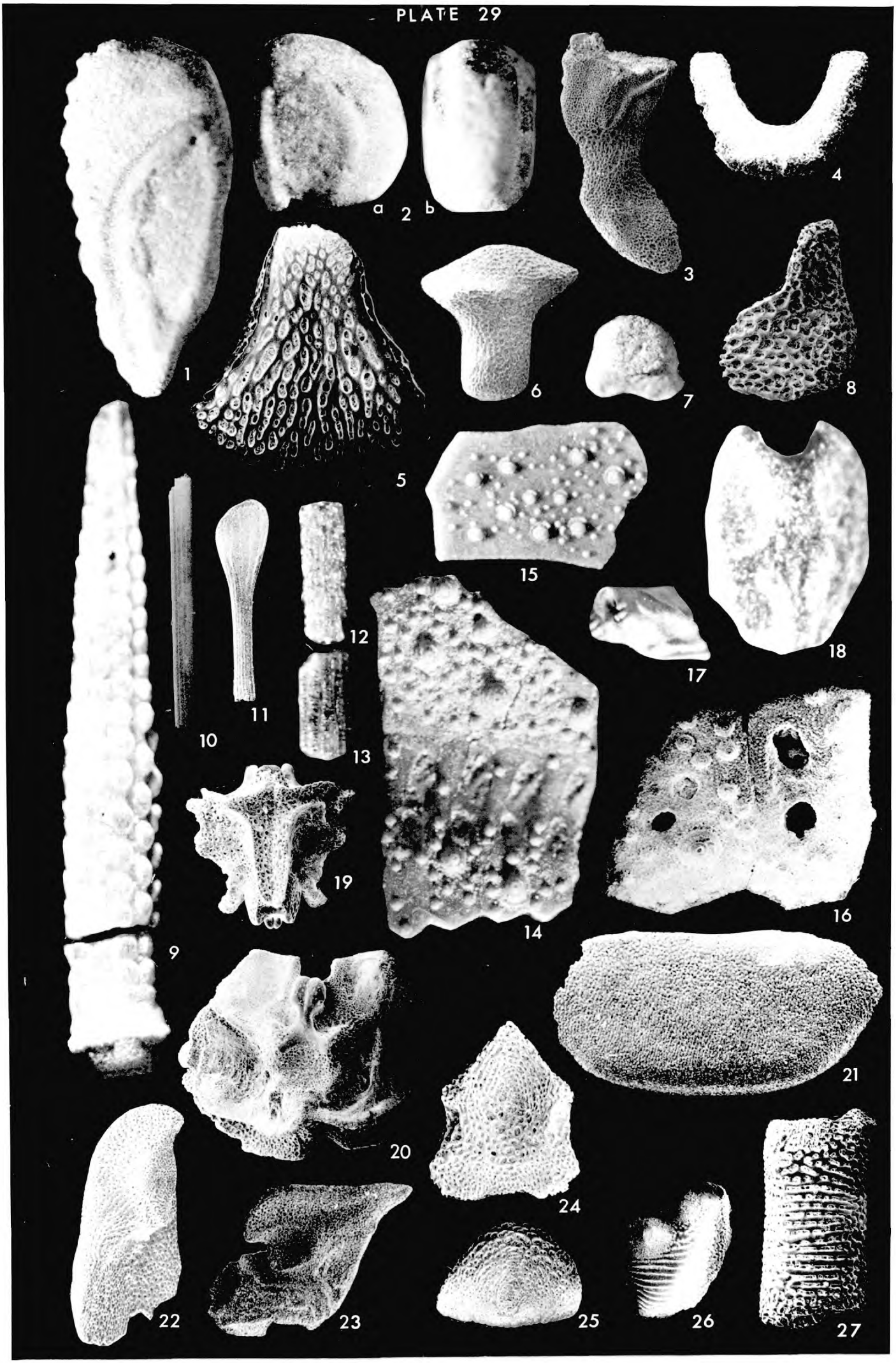

Plate 30.

Fig. 1. Priscopedatus multiforis SCHLUMBERGER. x 200. 6600 Alum Bay. Max. diam. 250u.

Fig. 2. Rigaudites cuvillieri (DEFLANDRE-RIGAUD). x 200. 0953 Barton (A/120/1045). Max.diam. 350u.

Fig. 3. ?Rigaudites cuvillieri (DEFLANDRE-RIGAUD). Lobed specimen, x 300. 6961 Barton. Length 150u.

Fig. 4. Holothuroid? sclerite type 1. Single layered specimen, x 200. 6960 Barton. Max.diam. 160u.

Fig. 5. Holothuroid? sclerite type 1. Double layered specimen, x 200. 6960 Barton. Max.diam. 140u.

Fig. 6. Tooth? type 17. x 10. 6906 Barton. Max.diam. 4100u.

Fig. 7. Tooth type 31. x 20. 6914 Barton. Length 1200u.

Fig. 8. Tooth type 39. x 10. 6638 Alum Bay. Length 5350u.

Fig. 9. Tooth type 1. Elongate specimen with root, x 20. 6906 Barton. Length 2850u.

Fig.10. Tooth type 1. Basally broader specimen, x 20. 6595 Alum Bay. Length 1300u.

Fig.11. Tooth type 3. x 10. 6710 Alum Bay. Length 3000u.

Fig.12. Tooth type 3. Large specimen, x 10. 6591 Alum Bay. Length 4650u.

Fig.13. Tooth type 4. x 20. 6895 Barton. Length 2700u.

Fig.14. Tooth type 18. x 10. 6906 Barton. Height 4950u.

Fig.15. Tooth type 33. x 20. 6921 Barton. Length 800u.

Fig.16. Tooth type 34. x 20. 6924 Barton. Length 1400u.

Fig.17. Tooth type 28. x 20. 6906 Barton. Width 950u.

Fig.18. Tooth type 32. x 20. 6923 Barton. Width 1700u.

Fig.19. Dermal denticle type 5. x 50. 6894 Barton. Width 550u.

Fig.20. Dermal denticle type 22. x 20. 6906 Barton. Length 950u.

Fig.21. Dermal denticle type 20. x 50. 6951 Barton. Length 700u.

Fig.22. Dermal denticle type 15. x 20. 6595 Alum Bay. Length 1400u.

Fig.23. Dermal denticle type 37. x 20. 6671 Alum Bay. Length 1550u.

Fig.24 Tooth type 2. x 20. 6588 Alum Bay. Length 1000u.

Fig.25. Tooth type 2. Inflated form, x 20. 6890 Barton. Length 1300u.

Fig.26. Scale type 16. x 20. 6894 Barton. Max.diam. 1400u.

Fig.27. Scale type 21. x 20. 6923 Barton. Max.diam.3100u.

Plate 30 (cont.)

Fig. 28. Antheas nota (SHEPHERD). Adult, x 10. 6673 Alum Bay. Length 5200u.

Fig.29. Antheas nota (SHEPHERD). Juvenile, x 20. 6606 Alum Bay. Length 1900u.

Fig.30. Bathyconger sp. x 10. 6906 Barton. Length 2750u.

Fig.31. Argentina hantoniensis (SCHUBERT). x 40. 6906 Barton. Max.diam. 1250u.

Fig.32. Apogon bellovacinus (FRIEM). x 10. 6699 Alum Bay. Length 3900u.

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PLATE 30

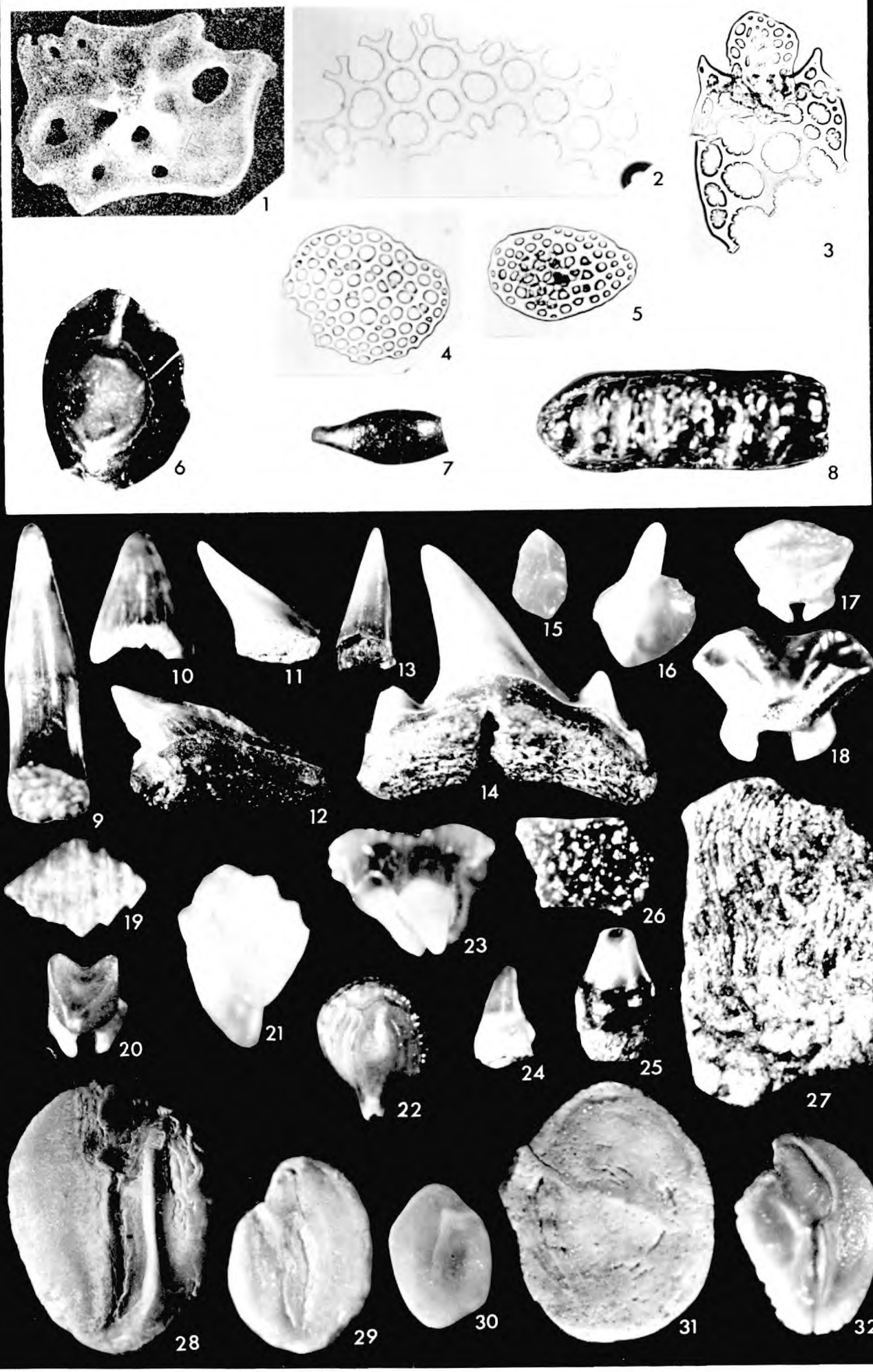
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Plate 31.

Fig.1. Callionymus sp. x 20. 6942 Barton. Length 1200u.

Fig.2. Citharichthys helectaroides STINTON.x 20. 6942 Barton. Length 1450u.

Fig.3. Beryx lerichei (SCHUBERT). x 10. 6907 Barton. Length 3900u.

Fig.4. Bregmaceros minimus (FROST). x 20. 6906 Barton. Length 1650u.

Fig.5. Cepola pantanelli (BASSOLI & SCHUBERT). x 20. 6905 Barton. Length 1650u.

Fig.6. Gadus dinidiatus (SCHUBERT). x20. 6906 Barton. Length 2300u.

Fig.7. Gymnocranius denticulatus (FROST).x20. 6909 Barton.Length 2900u.

Fig.8. Genypterus bartonensis (SCHUBERT). x20. 6906 Barton. Length 2200u.

Fig.9. Lutianus concavus (PRIEM). x10. 6906 Barton. Length 5400u.

Fig.10. Merluccius shepherdi (SCHUBERT). x10. 6642 Alum Bay. Length 4100u.

Fig.11. Muraenesox eocenicus (FROST). x10. 6910 Barton. Length 4800u.

Fig.12. Muraenesox ovatus (FROST). x10. 6944 Barton. Length 3250u.

Fig.13. Neobythites waltoni (SCHUBERT). x10. 6906 Barton. Length 3900u.

Fig.14. Peristedion denticulatus (STINTON m.s.). x20. 6954 Barton. Length 2350u

Fig.15. Ogilbia subregularis (SCHUBERT). x10. 6702 Alum Bay. Length 3450u.

Fig.16. Pterothrissus bartonensis (SCHUBERT). x20. 6702 Alum Bay.Length 2450u.

Fig.17. Pleisops sp. x 20. 6681 Alum Bay. Length 1200u.

Fig.18. Solea bartonensis (FROST). x20. 6906 Barton. Length 1800u.

Fig.19. Hilsa regularis STINTON. x20. 6948 Barton. Length 1300u.

Fig.20. Synodus rectus (FROST). x 20. 6941 Barton. Length 1600u.

Fig.21. Trachichthodes circularis STINTON. x20. 6906 Barton. Length 1400u.

Fig.22. Otolith sp.39. x20. 6587 Alum Bay. Length 1150u.

Fig.23. Otolith sp.54. x10. 6669 Alum Bay. Length 4400u.

Fig.24. Otolithsp.42. x 20. 6992 Barton. Length 1000u.

Fig.25. Otolith sp.43. x20. 6683 Alum Bay.Length 1350u.

Fig.26. Otolith sp.44. x50. 6598 Alum Bay. Length 600u.

Fig.27. Otolith sp.51. x20. 6683 Alum Bay. Length 1950u.

Fig.28. Otolith sp.45. x20. 6617 Alum Bay. Length 1000u.

Fig.29. Otolith sp.47. x20. 6639 Alum Bay. Length 1450u.

Fig.30. Otolith sp.55. x20. 6703 Alum Bay.Max.diam. 2400u.

Fig.31 Arius crassus (KOKEN). x10. 6617 Alum Bay. Max.diam.7300u.

Plate 31 (cont.)

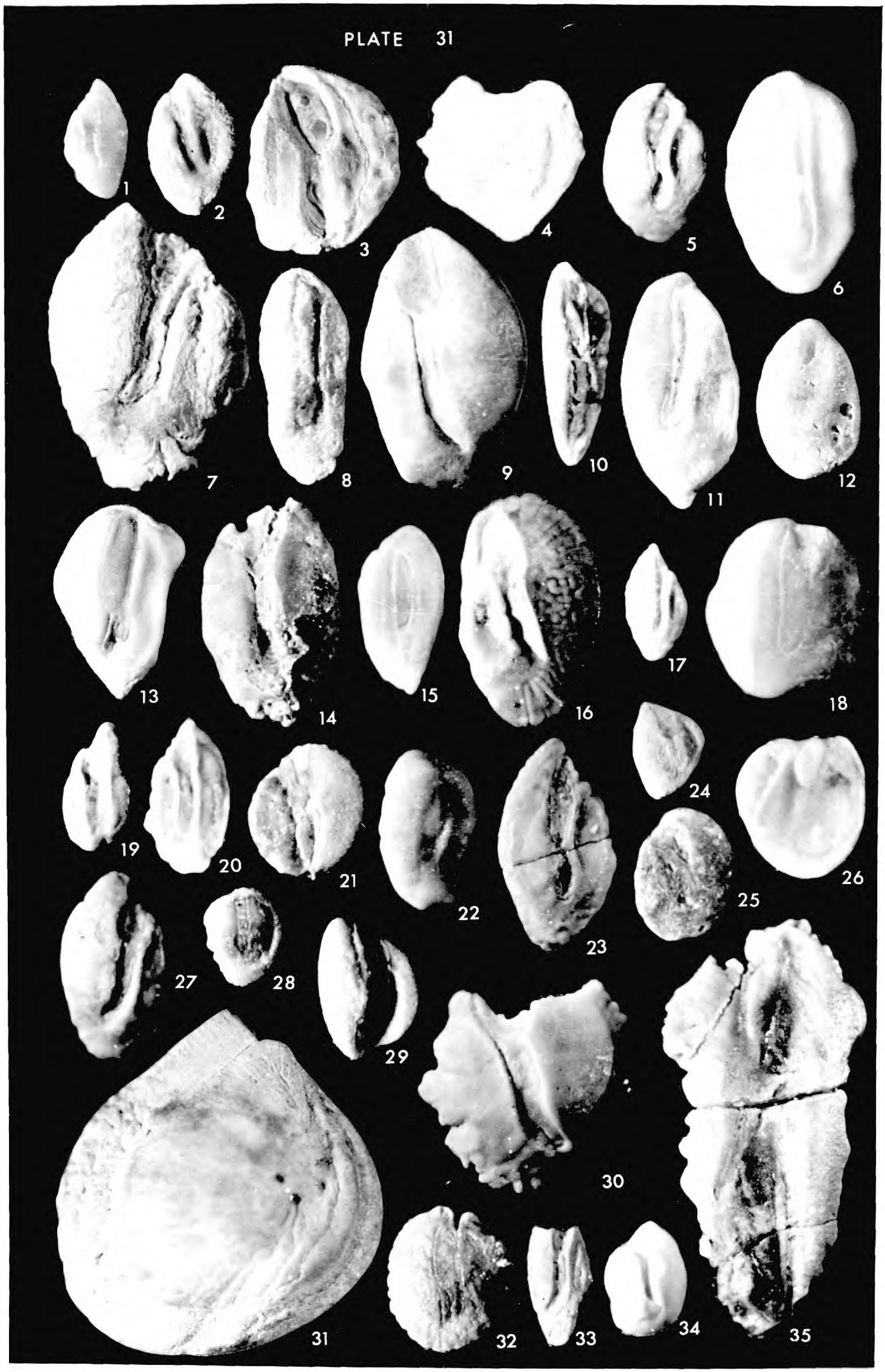
Fig. 32. Otolith sp.46. x 20. 6699 Alum Bay. Length 1450u.

Fig. 33. Otolith sp.49 x 10. Alum Bay. Length 2400u.

Fig. 34. Otolith sp.50 x 20. 6681 Alum Bay. Length 1175u.

Fig. 35. Otolith sp.48 x 10. 6673 Alum Bay. Length 8900u.

PLATE 31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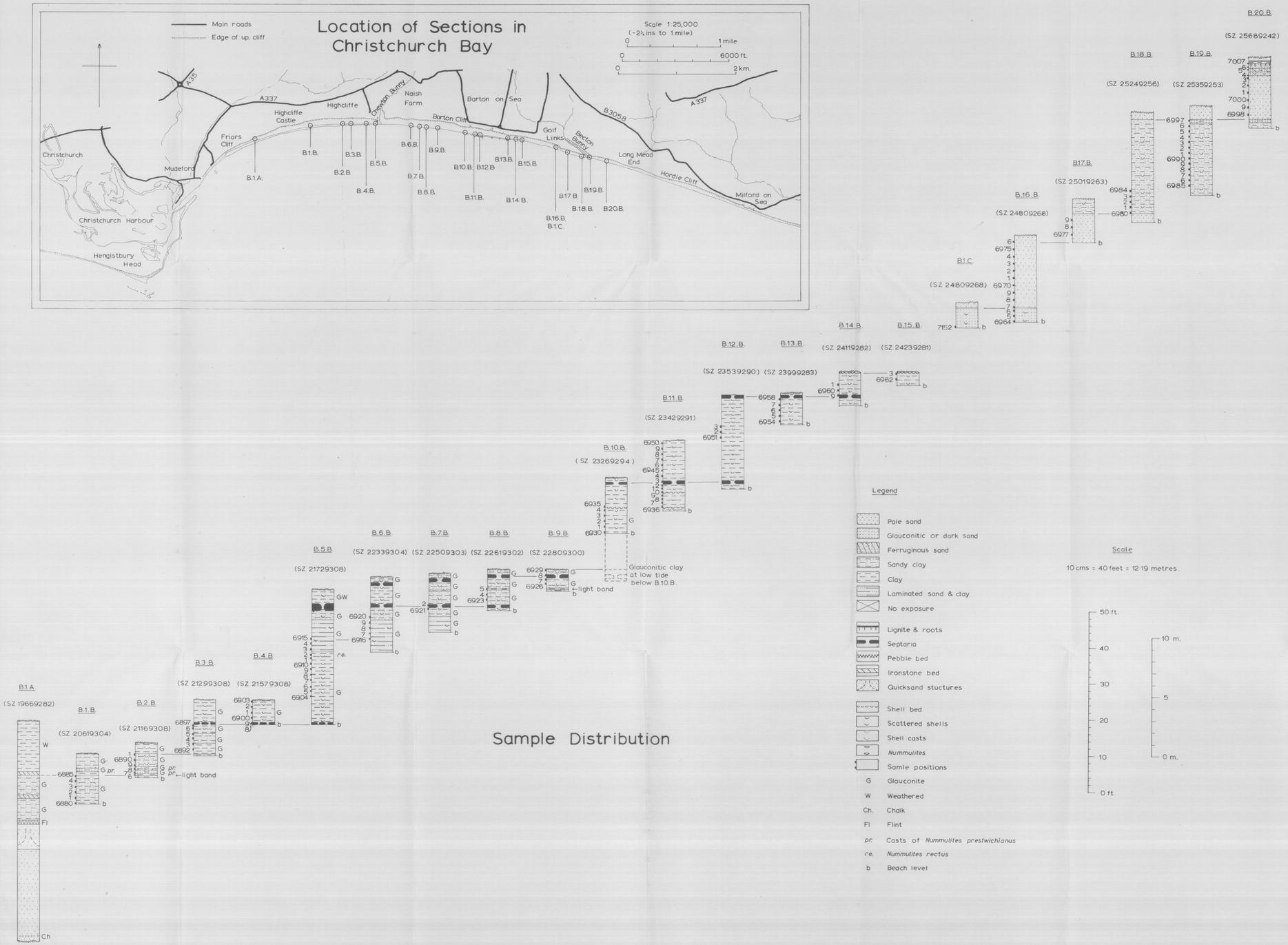
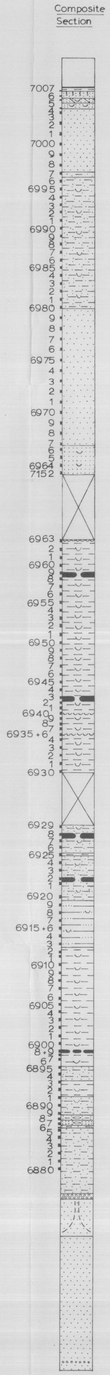
BARTON BEDS OF CHRISTCHURCH BAY





Stratigraphic Divisions of Barton, (1933)	Lithology	Thickness metres	Thickness ft	Thickness ins	Ht above base of Barton Beds metres	Ht above base of Barton Beds ft	Ht above base of Barton Beds ins
Lr. Head'n	Lignite	0·03	0	1	60·05	197	0
L	Stiff green clay	0·23	0	9	59·81	196	3
	Fine grey sand + borings & roots	0·38	1	3			
K	Ferruginous sandstone + shells	0·30	1	0	59·43	195	0
	Grey - khaki sand + shells	0·30	1	0	59·13	194	0
	Fine white sand	3·66	12	0	58·83	193	0
	Khaki sand & sandy clay	0·30	1	0	55·18	181	0
J	Dark grey-green sandy clay, weathering mauve + fragile shells	7·62	25	0	54·86	180	0
					47·25	155	0
I	Fine white sand	7·93	26	0			
	Dark grey to blue sand + abundant *Chama* & *Turritella*	1·68	5	6	39·33	129	0
H	Extensive slumping - no exposure	3·81	12	6	37·64	123	6
G	Shell bed				33·83	111	0
	Grey clay + abundant shells	1·83	6	0	32·00	105	0
	Closely spaced shelly septaria	0·30	1	0	31·70	104	0
F	Grey clay + abundant shells & seams of *Corbula*	6·86	22	6			
	Closely spaced shelly septaria	0·30	1	0	24·85	81	6
E	Grey to brown glauconitic clay + abundant shells & two shell beds	1·98	6	6	24·54	80	6
	Green - grey glauconitic clay & sandy clay + shells	2·13	7	0	22·56	74	0
D	Extensive slumping - no exposure	3·05	10	0	20·42	67	0
	Glauconitic sandy clay + shells	0·46	1	6	17·38	57	0
	Widely spaced septaria	0·30	1	0	16·92	55	6
	Glauconitic sandy clay + shells	0·84	2	9	16·62	54	6
C	Burrowed pale grey clay	0·15	0	6	15·77	51	9
	Glauconitic sandy clay + shells	1·22	4	0	15·62	51	3
	Widely spaced septaria	0·30	1	0	14·40	47	3
B	Dark green glauconitic sandy clay + rare shells	1·07	3	6	14·10	46	3
A3	Shelly glauconitic clay interbedded with fine laminated pale & dark grey sand	2·74	9	0	13·03	42	9
	Nummulites rectus near top				10·28	33	9
A2	Grey glauconitic clay + shell seams	5·94	19	6			
	Unconsolidated laterally discontinuous pale grey clay septaria	0·15	0	6	4·34	14	3
A1orA2	Glauconitic clay + shells	0·76	2	6	4·19	13	9
	Glauconitic sandy clay	0·84	2	9	3·43	11	3
A1	Grey glauconitic clay + shell casts	0·91	3	0	2·59	8	6
	Glauconitic sandy clay & clay + shell casts	1·07	3	6	1·68	5	6
	Glauconitic sandy clay + pyritised *Nummulites prestwichianus*	0·30	1	0	0·61	2	0
	Highly glauconitic sand + pyritised *Nummulites prestwichianus*	0·30	1	0	0·31	1	0
	Pale glauconitic sandy clay	0·15	0	6	0·00	0	0
	Coarse dark green glauconitic sandy clay	3·81	12	6	- 0·15	- 0	6
	Flint pebble bed	0·30	1	0	- 3·96	-13	0
Ā	Fine white sand + quicksand structures	2·13	7	0	- 4·26	-14	0
					- 6·39	-21	0
Up Brack. ?	Fine white & buff sand + lignite	7·24	23	9			
	Line of chalk pebbles				-13·64	-44	9
	Fine white sand	0·46	1	6			

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BARTON BEDS OF ALUM BAY

2

Sample Distribution

Lithology	Thickness metres	Thickness ft ins	Ht. above base of Barton Beds metres	Ht. above base of Barton Beds ft ins
Upper Barton Beds				
Fine white & buff sand				
Thin ferruginous layer	<0.01	<0 0.5	72.28	247 0
Fine speckled yellow & white sand	3.51	11 6		
			71.78	235 6
?				
Dark grey sandy clay	2.29	7 6		
			69.49	228 0
Ferruginous clay & nodules	0.46	1 6	69.04	226 6
Interbedded grey clay & fine white sand	3.51	11 6		
			65.53	215 0
Blue shelly clay	0.76	2 6		
Layer of small ironstone nodules	<0.08	<0 3	64.77	212 6
Middle Barton Beds				
Blue-grey clay + abundant shells & seams of *Corbula*	13.11	43 0		
			51.66	169 6
Extensive slumping in stream valley - no exposure	3.66	12 0		
			48.01	157 6
Blue-grey clay + abundant shells	2.13	7 0		
			45.87	150 6
Closely spaced shelly septaria	0.46	1 6	45.41	149 0
Blue glauconitic clay + abundant shells & scattered pebbles, passing up into a discontinuous flint pebble bed	0.76	2 6		
			44.65	146 6
Pale green glauconitic slightly clayey sand + lenses of mauve clay & lignite	9.75	32 0		
			34.90	114 6
Mauve weathered clay interbedded with glauconitic sand & lignite	2.13	7 0		
			32.76	107 6
Dark green glauconitic sandy clay + abundant shells	2.13	7 0		
			30.63	100 6
Widely spaced septaria	0.30	1 0	30.33	99 6
Dark green glauconitic sandy clay + abundant shells	1.52	5 0		
			28.80	94 6
Glauconitic sandy clay + shells & small scattered quartz pebbles	0.76	2 6		
			28.04	92 0
Dark green glauconitic sandy clay + abundant shells	7.32	24 0		
			20.73	68 0
Widely spaced septaria	0.30	1 0	20.42	67 0
Dark green glauconitic sandy clay + abundant shells	1.83	6 0		
			18.59	61 0
Lower Barton Beds				
Grey laminated clay interbedded with fine yellow & white sand + rare lenses of lignite	5.94	19 6		
			12.65	41 6
Blue-grey glauconitic clay + rare seams of fine yellow sand & abundant shells	10.97	36 0		
			1.68	5 6
Septaria	0.15	0 6	1.52	5 0
Blue shelly glauconitic clay	0.91	3 6		
			0.61	2 0
Blue glauconitic clay + abundant shells & *Nummulites prestwichianus*	0.61	2 0		
			0.00	0 0
Upper Bracklesham Beds ?				
Blue to dark green glauconitic sandy clay with shells & shell casts	11.58	38 0		
			-11.58	-38 0
Ferruginous clay	0.30	1 0	-11.89	-39 0
Weathered mauve & green glauconitic sandy clay	1.22	4 0		
			-13.11	-43 0
Ferruginous & glauconitic orange & purple clay	0.61	2 0		
			-13.72	-45 0
Weathered mauve & green glauconitic sandy clay	2.90	9 6		
			-16.62	-54 6
Orange ferruginous clay	0.30	1 0	-16.91	-55 6
Weathered mauve glauconitic sandy clay	5.33	17 6		
			-22.25	-73 0
Flint pebble bed	0.23	0 9	-22.48	-73 9
M. Brack.?				
Fine orange, yellow & white sand				

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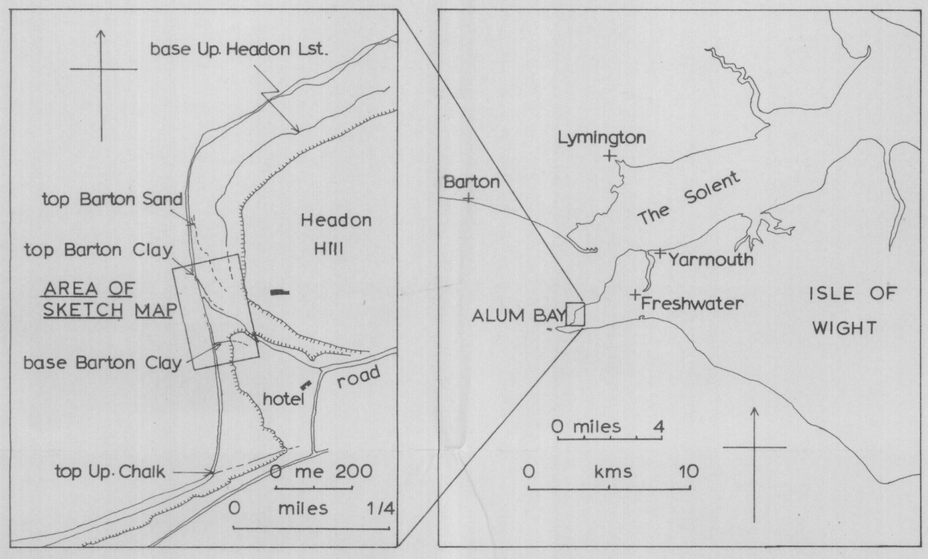
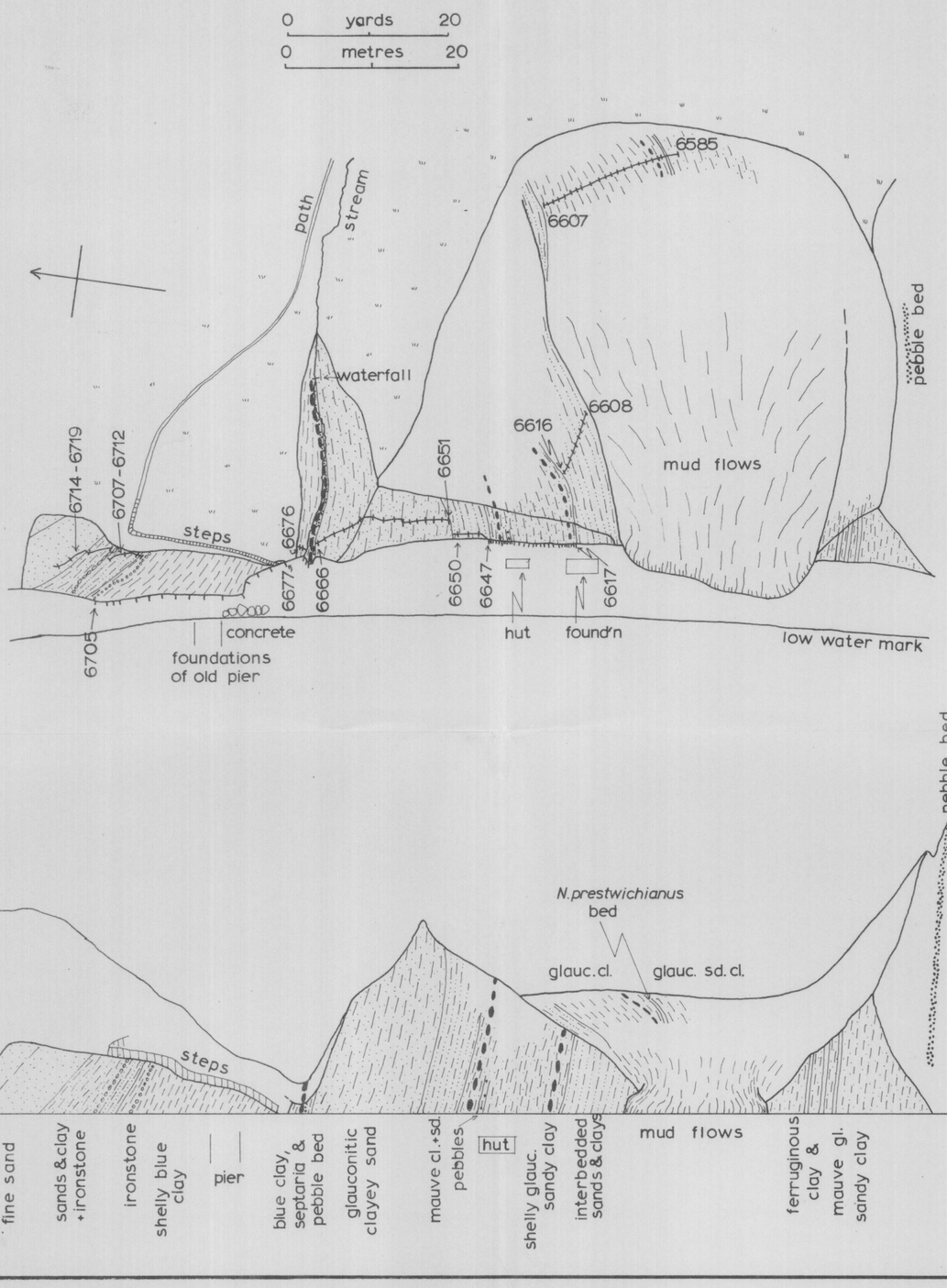
Sample Location

Location of Section



Sketch Map and Elevation of Barton Beds of Alum Bay



LEGEND

- Pale sand
- Clayey sand
- Ferruginous clay
- Sandy clay
- Clay
- Laminated sand & clay
- No exposure
- Scattered pebbles
- Septaria
- Pebble bed
- Ironstone nodules
- Scattered shells
- Shell casts
- *Nummulites*
- Sample positions

SCALE

10cms = 40 ft = 12.19 metres

50 ft. — 40 — 30 — 20 — 10 — 0 ft.

10 m. — 5 — 0 m.

LITHOLOGICAL CORRELATIONS IN THE HAMPSHIRE UPPER EOCENE :- SOUTHERN SERIES

3

100 ft. — 20 m. — 50 — 0 m. — 0 ft.

Scale: 1cm.= 10 ft.= 3·05 m.

① WHITECLIFF BAY (Fisher 1862, White 1921, M.N.) SZ 640862

② BEMBRIDGE No 2 (Whitaker 1910) SZ 643872

⑤ ALUM BAY (Prestwich 1846(z), White 1921, M.N.) SZ 305855

⑥ BOLDRE No 2 (Whitaker 1910) SZ 346954

⑧ MILFORD (Whitaker 1910) SZ 310915

⑨ MILTON (Whitaker 1910) SZ 242952

⑦ LYMINGTON (Whitaker 1910) SZ 317970

⑩ CHRISTCHURCH BAY (Burton 1933, Curry + Wisden 1958, M.N.) SZ 192926 - 289913

⑭ LYNDHURST (Whitaker 1910) SU 300083

⑬ POULNOR (Burton 1933) SU 175057

⑫a UP. BRANSGORE (Burton 1933) SZ 192983

⑪ HENGISTBURY HEAD (Gardner 1879, Curry 1942, M.N.) SZ 1790

⑫b LR. BRANSGORE SZ 185977

④ AFTON BRICKYARD (Curry 1942) SZ 368864

③ GUNVILLE BRICKYARD (Curry 1942) SZ 478886

Fisher's beds

Burton's beds

XIX + XVIII

CYCLES	STAGE NAMES
O	MIDDLE HEADON BEDS CYCLE — LATTORFIAN
H	
S	
Bb	
Ch	BARTON BEDS CYCLE — BARTONIAN
Bm	
R	
V/V' / T	UPPER BRACKLESHAM BEDS CYCLE — AUVERSIAN
M + C	
L	MIDDLE BRACKLESHAM BEDS CYCLE — LUTETIAN
X	LOWER BRACKLESHAM BEDS CYCLE — CUISIAN
Y	LONDON CLAY CYCLE — YPRES'N

Pre-1910 boreholes — Surface sections

- Clay
- Sandy clay
- Laminated clay
- Pipeclay
- Sand
- Clayey sand
- Interbedded sands & clays
- Sandstone
- Septaria
- Pebble bed
- Shell bed
- Lignitic lens
- Ironstone
- Scattered shells
- Shell casts
- No exposure

c Non-marine unit
g Glauconite
f Marine fossils
(f) Casts of marine fossils
w Pale sands
Inferred depositional break

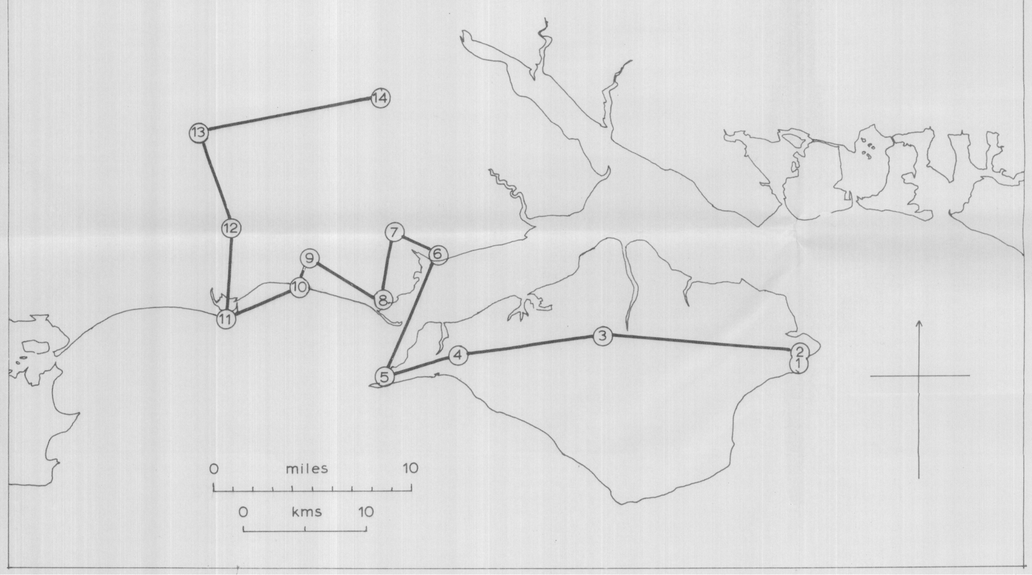
O M.Headon beds
H Lr.Headon beds (non-marine)
S Pale Barton Sands facies
Bb Becton Bunny clays etc.
Ch *Chama* bed
Bm Marine Barton clays etc.
R *"Rimella canalis"* bed
V *Nummulites variolarius* bed
V' ditto - decalcified facies
T *Tellina* bed equivalents
B Brook bed equivalents
M *Macrosolen hollowaysi, Miocardia,* Little beds + equivalents
C *Campanile* bed

L *Nummulites laevigatus* bed
X Lr. Bracklesham beds
Y Bagshot Sands

(I) *Nummulites sp. 1*
(R) *N. rectus*
(P) *N. prestwichianus*
(A) *N. sp. 2*
(V) *N. variolarius*
(L) *N. laevigatus*
(Pl) *N. planulatus*

1 *Cerithids*
2 *Corbicula deperdita*
3 *Chama sqammosa*
7 *Corbula pisum*
8 *Ostrea tenera*
9 *Amusium corneum*
10 *Macrosolen hollowaysi*
11 *Campanile spp.*
13 *Venericardia planicosta*
17 *Tibia sublucida*

Location of Sections



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LITHOLOGICAL CORRELATIONS IN THE HAMPSHIRE UPPER EOCENE :- NORTHERN SERIES

Pre-1910 boreholes

- Pale sands
- Sandy clay
- Laminated clay
- Sandstone
- Septaria
- Pebble bed
- Ironstone
- Lignite
- Lignitic lenses

Surface sections

- Dark or glauconitic sand
- Clay
- Interbedded sands & clays
- Clayey sand
- Scattered shells
- Shell bed
- Shell casts
- *Nummulites*
- No exposure

- c Non-marine unit
- g Glauconite
- f Marine fossils
- (f) Casts of marine fossils
- w Pale sands
- Inferred depositional break

- O M. Headon beds
- H Lr. Headon beds (non-marine)
- S Pale Barton Sands facies
- Ch *Chama* bed
- Bm Marine Barton clays etc.
- Hu Huntingbridge bed
- V *Nummulites variolarius* bed
- T *Tellina* bed + equivalents
- B Brook bed + equivalents
- Mo *Miocardia* bed + equivalents
- Mi *Macrosolen hollowaysi*, Little bed + equivalents
- C *Campanile* bed
- Ot *Ostrea tenera* bed
- L *Nummulites laevigatus* bed
- X Lr. Bracklesham beds
- Y Bagshot Sands

- (R) *Nummulites rectus*
- (P) *N. prestwichianus*
- (H) *N. sp. 3*
- (V) *N. variolarius*
- (I) *N. sp. 1*
- (L) *N. laevigatus*
- (Pl) *N. planulatus*
- (N) uncertain spp.

1 *Cerithids*
2 *Paracyathus*
3 *Chama squamosa*
4 *Pinna*
5 *Dentalium*
7 *Corbula pisum*
8 *Ostrea tenera*
9 *Amusium corneum*
10 *Macrosolen hollowaysi*
11 *Campanile* spp.
13 *Venericardia planicosta*
17 *Tibia sublucida*

(1) WHITECLIFF BAY
(Fisher 1862 - bed nos, O.White 1921, M.N.)
SZ 640862

(16) NOMAN FORT
(Reid & Strahan 1889)
SZ 639938

(20) DIBDEN
(Whitaker 1910)
~ SU 415062

(17) HORSE SAND FORT
(Reid & Strahan 1889)
SZ 655949

(21) HYTHE
(Whitaker 1910)
~ SU 4207

(22) ELING
(Whitaker 1910)
SU 364100

(19) FAWLEY TRANSMISSION TUNNEL
(Curry, Hodson & West 1968)
SU 477028 - 041501

(18) LEE-ON-SOLENT
(Fisher 1862 - bed nos)
~ SZ 5998 - SU 5402

(15) BRACKLESHAM BAY - SELSEA
(Fisher 1862 - bed nos thickness estimated)
SZ 816954 - 843931

(27) STUDLEY WOOD
(C.K.)
SU 228160

(26) HUNTINGBRIDGE
(Fisher 1862 - thickness estimated)
~ SU 250144

(25) BROOK
(Fisher 1862 - thickness estimated)
SU 265135

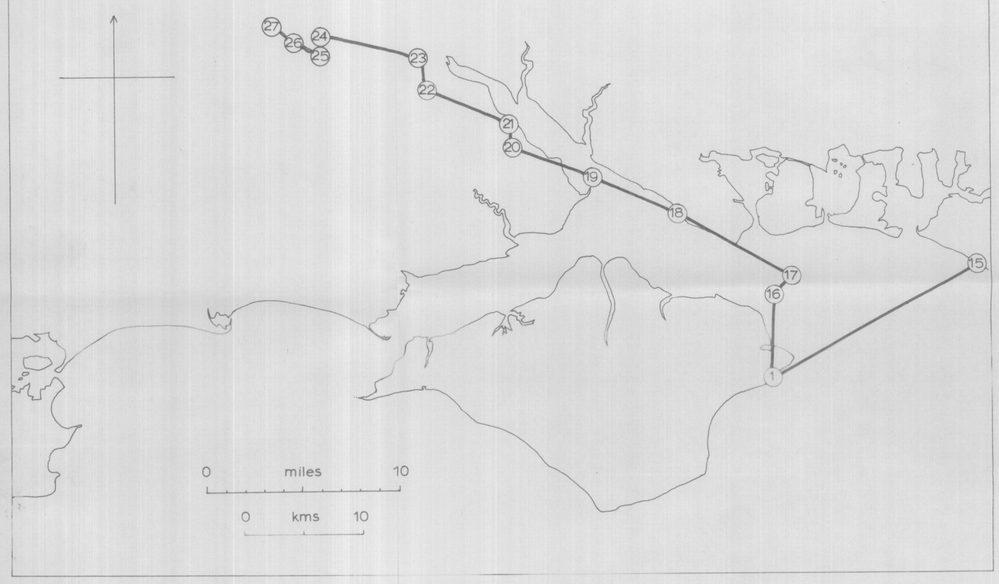
(24) BRAMSHAW
(Fisher 1862 - thickness estimated)
SU 264153

(23) TOTTON
(Burton 1933)
~ SU 356132

CYCLES / STAGE NAMES

	CYCLES	STAGE NAMES
O	MIDDLE HEADON B. CYCLE	LATTORFIAN
H		
S		
Ch	BARTON BEDS CYCLE	BARTONIAN
Bm		
Hu		
V	MIDDLE BRACKLESHAM BEDS CYCLE	AUVERSIAN
T		
B		
Mo		
Mi		
C		
Ot		LUTETIAN
L		
X	LOWER BRACKLESHAM BEDS CYCLE	CUISIAN
Y	LONDON CLAY CYCLE	YPRES'N

Location of Sections



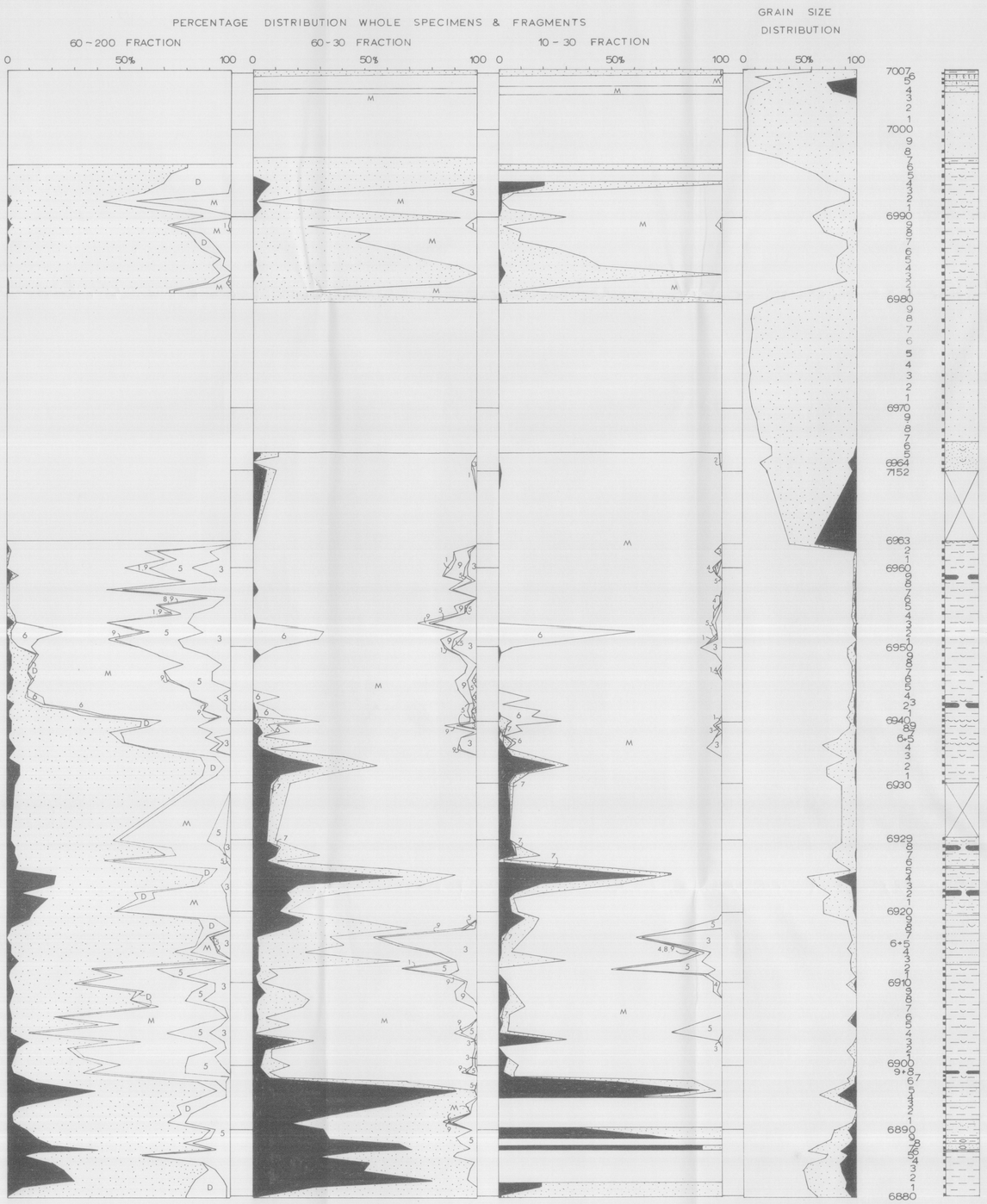
Scale : 1 cm. = 10 ft. = 3·05 m.

M. Norvick 1969

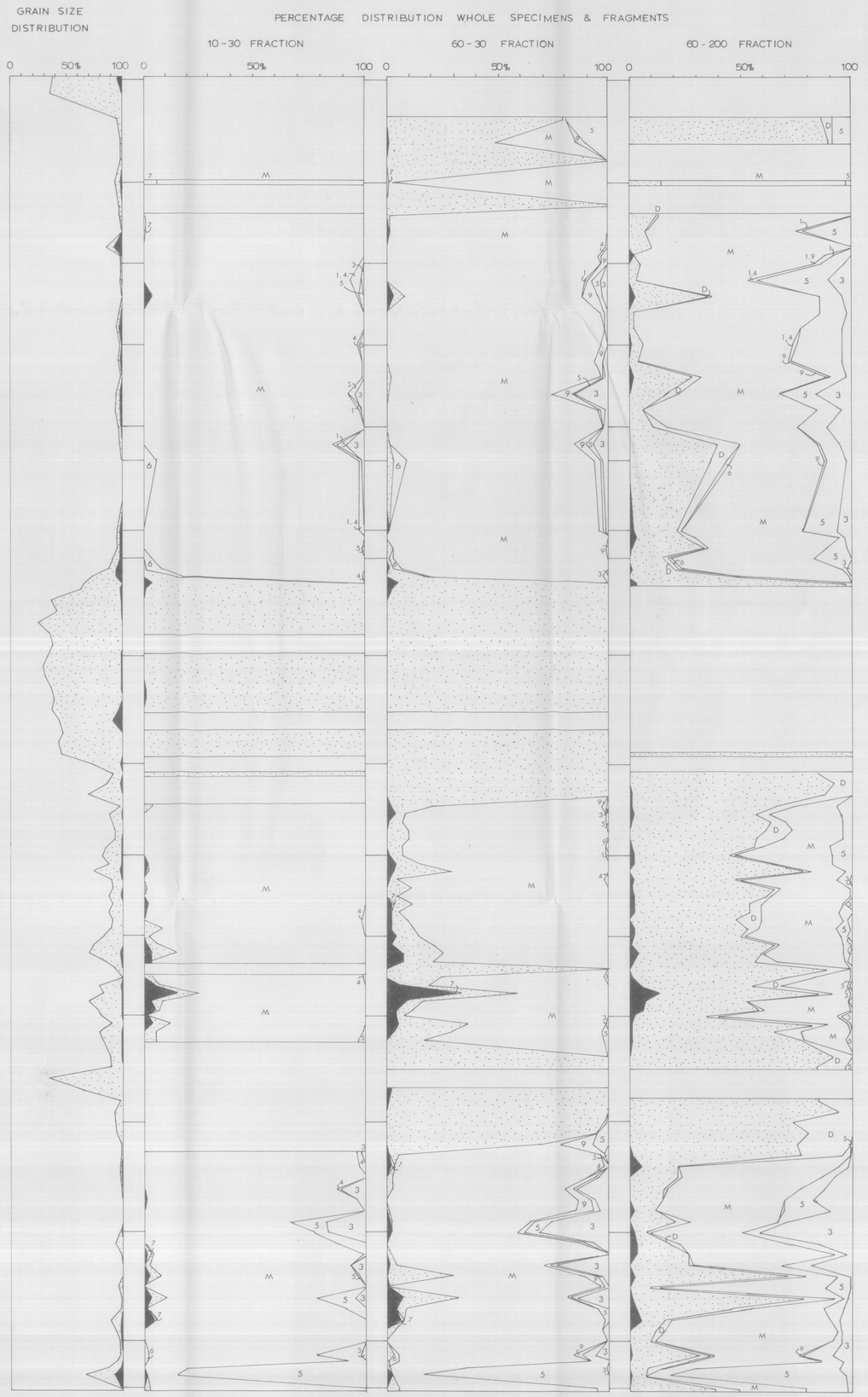
FRAGMENT AND GRAIN SIZE ANALYSES

5

CHRISTCHURCH BAY



ALUM BAY



FRAGMENT ANALYSIS

- Bone fragments, teeth & scales
- Plant remains & seeds
- M Mollusca & Mollusc fragments
- D Dinoflagellate cysts & Tasmanitids

1 Bryozoa
2 Balanus valves
3 Echinodermata
4 Corals & Coral fragments
5 Foraminiferida & fragments
6 Serpulid tubes & fragments
7 Teleost Otoliths & fragments
8 Crustacean fragments (excluding Ostracoda)
9 Ostracoda

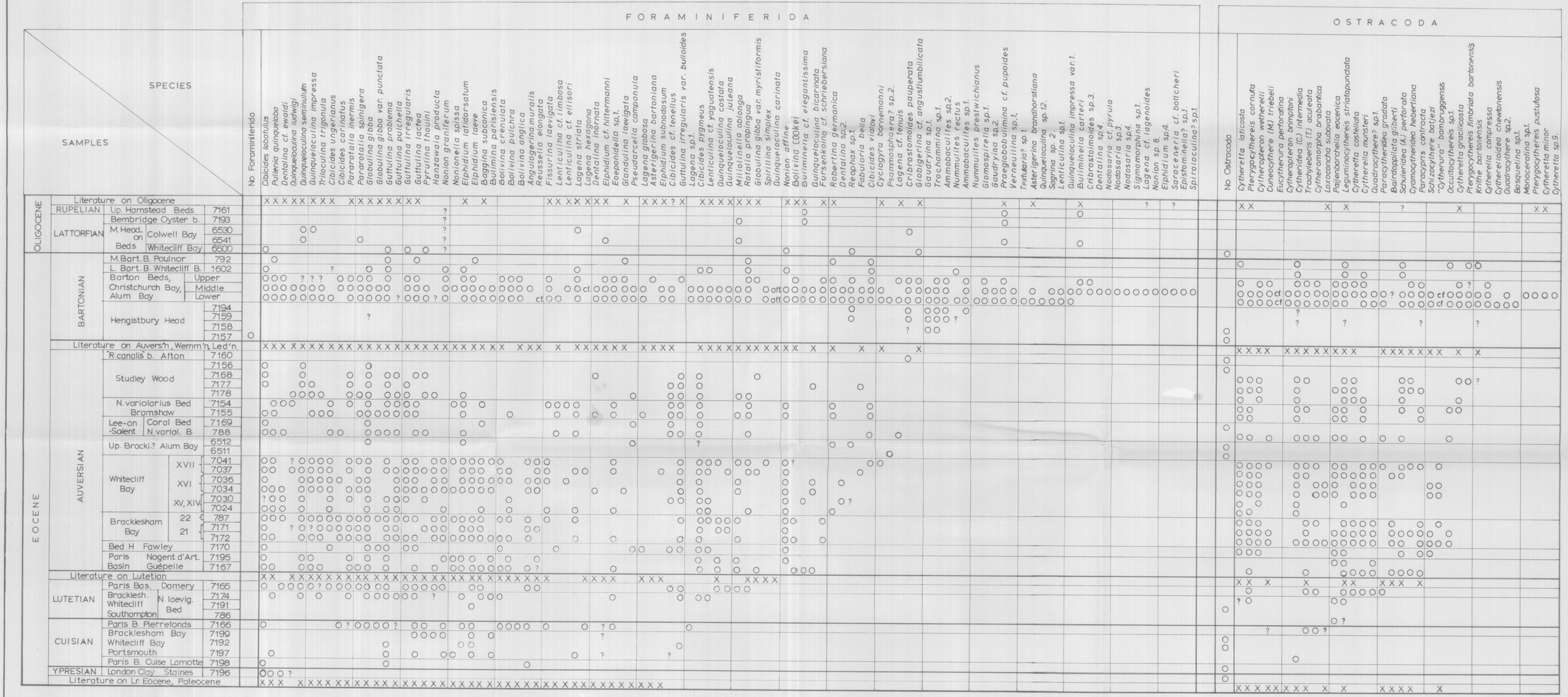
GRAIN SIZE ANALYSIS

- > 60 fraction
- 60 200 fraction
- < 200 fraction

Scale: 10 cms. = 40 ft. = 12·19 m.

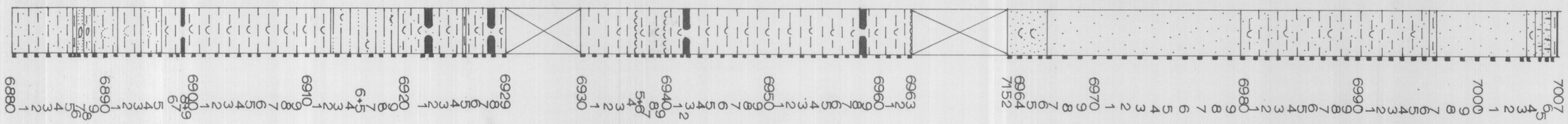
M. Norvick. 1969.

TOTAL RANGES OF BARTON BEDS FORAMINIFERIDA & OSTRACODA IN THE PALAEOGENE



M.Norvick. 1969.

TOTAL RANGES OF FORAMINIFERA IN THE BARTON BEDS OF CHRISTCHURCH BAY



Scale: 10 cms. = 40 ft. = 12.19 m.

O = Casts & questionable specimens

Cretaceous Foraminifera
Trochammina sp.1.
Reophax sp.1.
Ammobaculites sp.2.
Cribrostomoides pauperata
Glomospirella sp.1.
Miliolid Casts
Rotalia propingua
Ammobaculites sp.1.
Guttulina problema
Elphidium latidorsatum
Nonion graniferum
Fissurina laevigata
Pararotalia inermis
Globulina gibba
Guttulina lactea
Cibicides spp. indet.
Cribrostomoides sp.3.
"Microforaminifera"
Robertina germanica
Cibicides lobatulus
Globigerina cf. angustiumbilicata
Lagena striata
Praeglobobulimina cf. pupoides
Elphidium cf. hiltermanni
Guttulina irregularis
Elphidium laeva
Eoeponidella sp.1.
Bolivina pulchra
Pararotalia spinigera
Dentalina cf. ewaldi
Glandulina laevigata
Asterigerina bartoniana
Buliminella carteri
Globulina gibba var. myristiformis
Bolivina crenulata
Fursenkoina cf. schriebersiana
Bolivina cookei
Lagena cf. tenuis
Spirillina simplex
Pullenia quinqueloba
Quinqueloculina seminulum
Quinqueloculina impressa
Cibicides vialovi
Quinqueloculina costata
Quinqueloculina impressa var.1.
Miliolinella oblonga
Quinqueloculina bicarinata
Guttulina irregularis var. bulloides
Lagena sp.1.
Dentalina inornata
Quinqueloculina ludwigi
Quinqueloculina aff. carinata
Quinqueloculina juleana
Triloculina trigonula
Cyclogyra bornemanni
Bolivina anglica
Lagena globosa
Buliminella cf. elegantissima
Nodosaria sp.3.
Globulina gibba var. punctata
Pyrulina thouini
Fabularia bella
Lenticulina cf. yaguatensis
Cibicides cf. tenellus
Lagena cf. hexagona
Gaudryina sp.1.
Gaudryina sp.2.
Dentalina sp.4.
Lenticulina cf. ellisori
Cibicides pygmeus
Nonion affine
Elphidium sp.4.
Spiroloculina? sp. 1.
Lenticulina sp.1.
Asterigerina brandhorstiana
Verneuilina sp.1.
Nonionella spissa
Nodosaria cf. pyrula
Sagrina sp.2.
Dentalina sp.2.
Cibicides carinatus
Nonion sp. B.
Bulimina parisiensis
Lagena cf. lagenoides
Saracenaria cf. bottcheri
Sigmomorphina sp.1.
Nodosaria sp.4.
Epistominella? sp.1.
Baggina subconica
Elphidium subnodosum
Nummulites rectus
Cibicides ungerianus
Textularia? sp.1.
Hanzawaia producta
Psammosphaera? sp.2.
Lenticulina cf. limbosa
Agglutinated Foraminiferid Fragments
Casts of other Foraminiferida
Nummulites prestwichianus (casts)

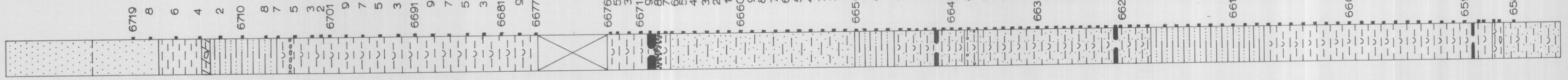
M. Norvick. 1969.

TOTAL RANGES OF FORAMINIFERA IN ALUM BAY

Scale 10cms = 40 ft. = 12.19 m. O = Casts & questionable specimens.

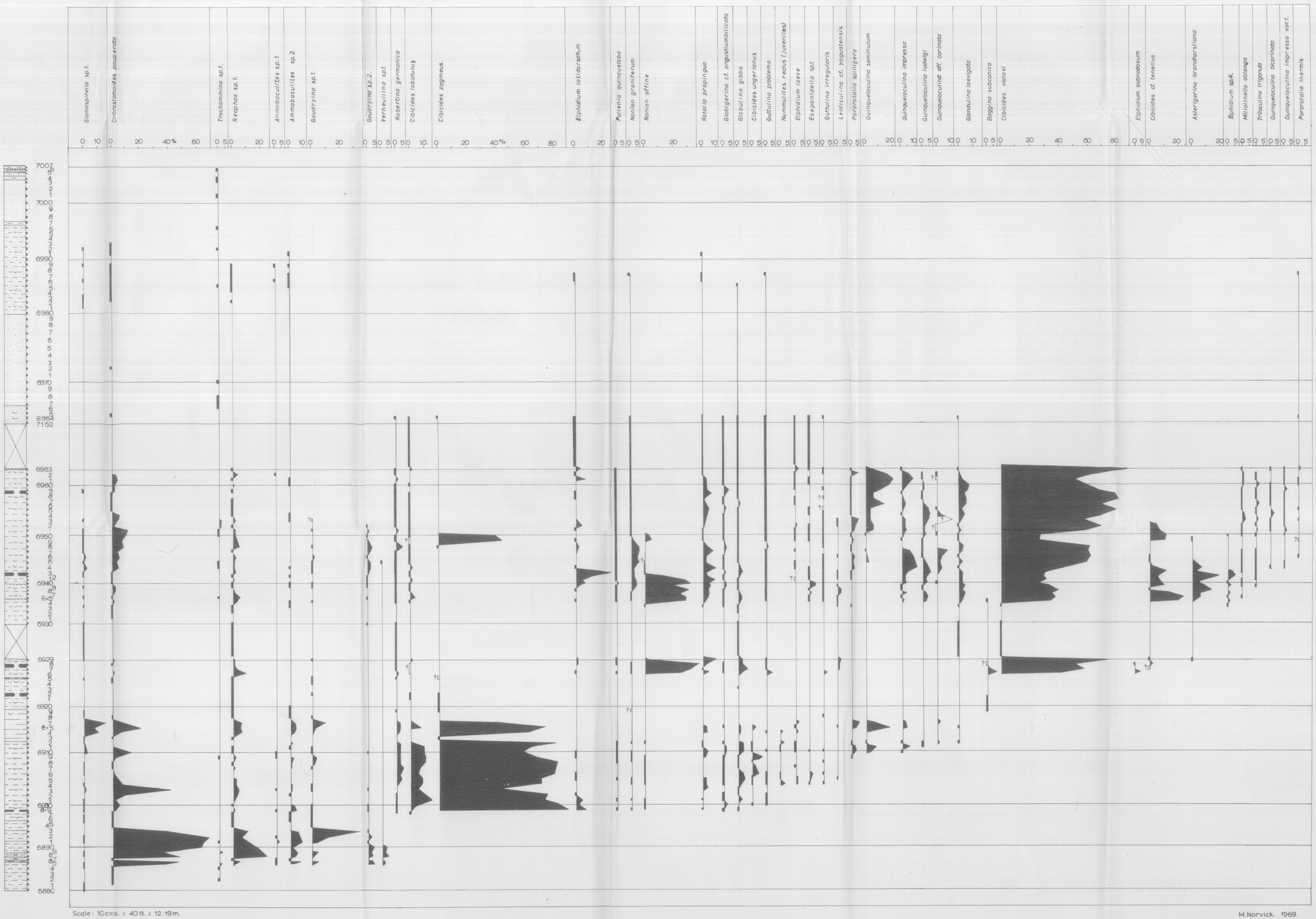
M. Norvick 1969

- *Cretaceous Foraminifera (Reworked)*
- *Reophax sp.1.*
- *Cribrostomoides pauperata*
- *Ammobaculites sp.2*
- *Glomospirella sp.1*
- *Trochammina sp.1.*
- *Cribrostomoides sp.3.*
- *Miliolid Casts*
- *Glandulina laevigata*
- *Cibicides lobatulus*
- *Cibicides vilatovi*
- *Rotalia propinqua*
- *Globigerina cf. angustumbilicata*
- *Pullenia quinqueloba*
- *Nonion granuiferum*
- *Robertina germanica*
- *Elphidium latidorsatum*
- *Fissurina laevigata*
- *Globulina gibba*
- *Elphidium laeve*
- *Cibicides carinatus*
- *Ammobaculites sp.1.*
- *Fursenkoina cf. schreibersiana*
- *Bolivina anglica*
- *Guttulina problema*
- *Eoeponidella sp.1.*
- *Guttulina lactea*
- *Paratrotalia spinigera*
- *Bolivina pulchra*
- *Bolivina crenulata*
- *Guttulina irregularis var. bulloides*
- *Parrotrotalia inermis*
- *Quinqueloculina seminulum*
- *Quinqueloculina impressa*
- *Quinqueloculina juleana*
- *Quinqueloculina bicarinata*
- *Lagena striata*
- *Quinqueloculina ludwigi*
- *Microroramilfera*
- *Miliolinella oblonga*
- *Quinqueloculina impressa var.1.*
- *Globulina gibba var punctata*
- *Triloculina trigonula*
- *Cyclogyra bornemanni*
- *Dentalina cf. ewaldi*
- *Pyrulina thouini*
- *Guttulina irregularis*
- *Dentalina inornata*
- *Fabularia bella*
- *Elphidium cf. hitterman i*
- *Quinqueloculina aff. carinata*
- *Cibicides cf. teneilus*
- *Lenticulina cf. yaguatensis*
- *Lenticulina sp.1.*
- *Saggrina sp.2.*
- *Quinqueloculina costata*
- *Elphidium subnodosum*
- *Bulimina elia carinata*
- *Guadryina sp.1.*
- *Bulimina cf. elegantissima*
- *Lagena globosa*
- *Epistomiella ? sp1.*
- *Dentalina sp.2.*
- *Vernedina sp.1.*
- *Dentalina sp.4.*
- *Lagena sp.1.*
- *Asterigerina brandhorstiana*
- *Praegloboulimina pupoides*
- *Bolivina cookei*
- *Nonion affine*
- *Elphidium sp. 4.*
- *Nodosaria cf. pyrula*
- *Saracenaria cf. bottcheri*
- *Pseudarcella campanula*
- *Cibicides pygmeus*
- *Sigmomorphina sp. 1.*
- *Gaudryina sp. 2.*
- *Anguliogerina murcalis*
- *Lagena cf. tenuis*
- *Baggina subconica*
- *Cibicides ungerianus*
- *Nummulites rectus*
- *Bulimina parisiensis*
- *Quinqueloculina sp. 12.*
- *Lenticulina cf limbosa*
- *Spirillina simplex*
- *Reusseila elongata*
- *Guttulina pulchella*



PERCENTAGE DISTRIBUTION OF FORAMINIFERIDA IN THE BARTON BEDS OF CHRISTCHURCH BAY : 60-200 FRACTION

Sample nos	No. specimens counted	Total % plotted
7007	x	
6	x	
5	0	
4	x	
3	x	
2	x	
1	x	
7000	x	
9	x	
8	x	
7	0	
6	1	
5	0	
4	x	
3	x	
2	2	
1	3	
6990	0	
9	16	
8	5	
7	22	
6	20	
5	6	
4	4	
3	5	
2	25	
1	1	
6980	0	
9	x	
8	x	
7	x	
6	x	
5	x	
4	0	
3	x	
2	x	
1	x	
6970	x	
9	x	
8	x	
7	x	
6	x	
5	x	
4	x	
6964	x	
7152	x	
3	227	98
2	748	95
1	815	94
6960	536	96
9	656	96
8	903	96
7	578	94
6	751	95
5	848	95
4	499	96
3	731	97
2	693	93
1	579	94
6950	1059	94
9	729	97
8	466	96
7	634	94
6	563	91
5	507	91
4	577	93
3	498	93
2	548	94
1	563	93
6940	454	94
9	568	92
8	327	94
7	386	98
5+6	836	94
4	378	96
3	26	–
2	3	–
1	2	–
6930	15	–
6929	267	93
8	193	98
7	72	100
6	159	98
5	25	–
4	6	–
3	3	–
2	3	–
1	7	–
6920	29	–
9	21	–
8	9	–
7	65	102
5+6	196	97
4	70	99
3	18	–
2	225	93
1	308	96
6910	326	96
9	379	98
8	392	97
7	374	96
6	234	96
5	290	95
4	605	97
3	155	96
2	245	96
1	460	97
6900	574	98
8+9	632	97
7	26	–
6	28	–
5	13	–
4	13	–
3	115	99
2	267	100
1	330	99
6890	74	100
9	83	99
8	74	100
7	34	–
6	134	100
5	203	98
4	46	–
3	12	–
2	10	–
1	5	–
6880	9	–



Scale : 10cms. = 40ft. = 12·19m.

M.Norvick. 1969.

PERCENTAGE DISTRIBUTION OF FORAMINIFERA IN 60-200 FRACTION: ALUM BAY

Sample no	No Foraminifera counted	Total % plotted
6719	0	-
8	0	-
6	142	99
4	294	98
2	0	-
6710	9	-
8	0	-
7	207	97
5	348	98
3	210	97
2	332	96
6701	608	97
9	562	96
7	360	94
5	552	95
3	728	98
6691	683	96
9	542	96
7	374	93
5	553	95
3	388	94
6681	446	95
9	435	94
6677	449	92
6	567	94
5	357	92
3	455	92
6671	280	93
9	506	94
8	334	94
7	53	102
6	0	-
5	0	-
4	0	-
3	0	-
2	0	-
1	0	-
6660	0	-
9	0	-
8	0	-
7	0	-
6	500	93
5	292	96
4	305	96
3	247	94
2	371	97
1	320	96
6640	477	97
9	264	96
8	247	95
7	390	96
6	241	97
5	161	96
4	245	97
3	322	97
2	383	98
1	438	97
6630	389	98
9	247	96
8	269	94
7	235	97
6	24	
5	76	99
4	44	
3	53	100
2	155	98
1	107	98
6620	239	96
9	283	99
8	246	95
7	243	97
6	1	-
5	33	-
4	0	-
3	0	-
2	0	-
1	0	-
6610	0	-
9	1	-
8	15	-
7	27	-
6	313	96
5	389	98
4	585	95
3	598	95
2	453	95
1	345	95
6600	323	90
9	501	96
8	420	100
7	552	95
6	433	97
5	604	95
4	63	100
3	164	99
2	241	96
1	279	94
6590	354	96
9	396	98
8	524	94
7	357	95
6	372	94
6585	587	96

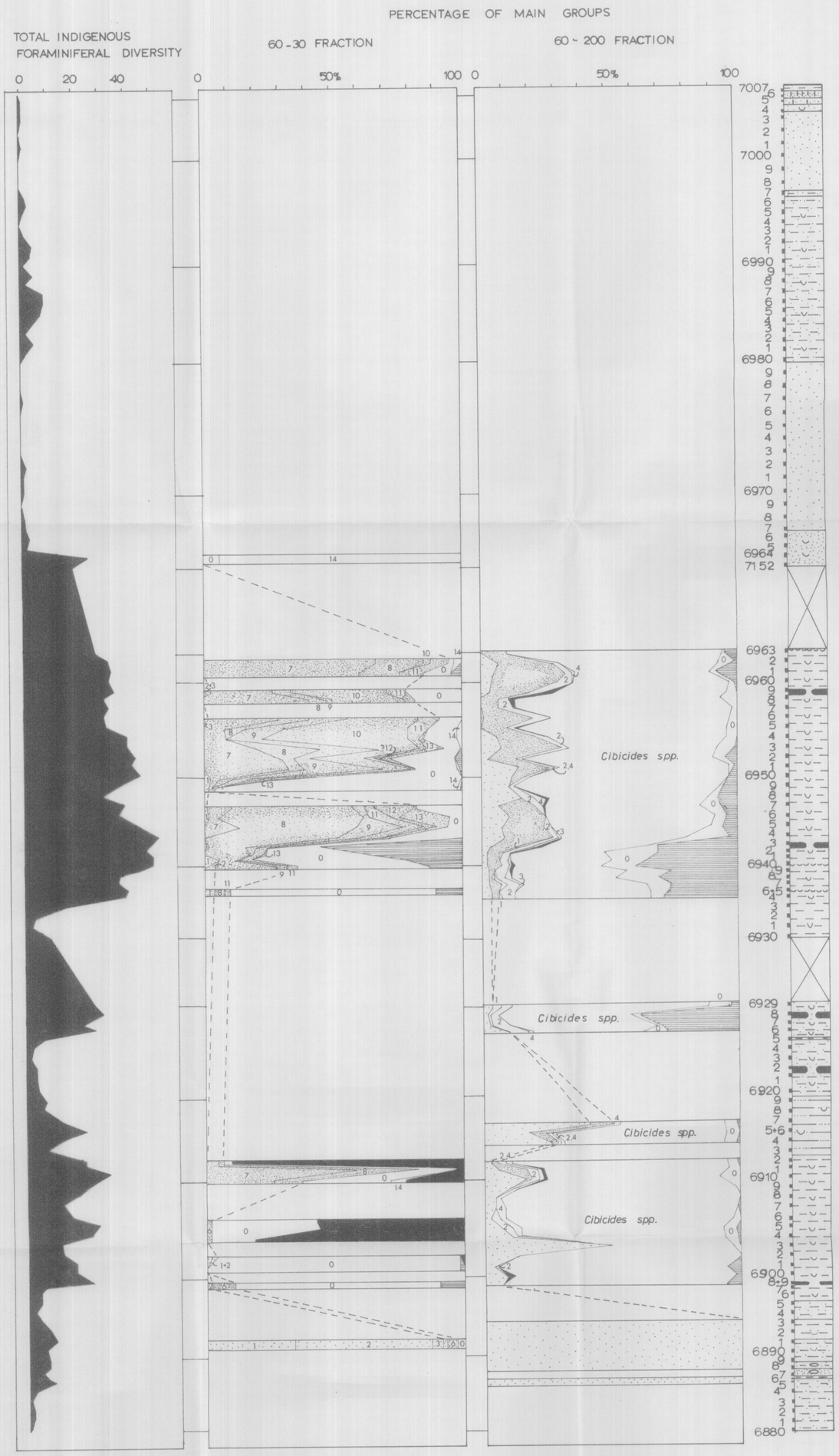
Cibicides pygmeus
Cibicides refulgens
Cibicides cf. tenellus
Cibicides lobatulus
Cibicides ungerianus
Rectuvax sp.1.
Cribrostomoides jeffreysi
Rotalia propinqua
Globigerina cf. angustiumbilicata
Lenticulina cf. yeguaensis
Globulina gibba
Pullenia quinqueloba
Nonion graniferum
Elphidium subnodosum
Nonion affine
Robertina germanica
Elphidium articulatum
Glomospirella sp.1.
Bolivina anglica
Guttulina problema
Nummulites spp. (juveniles)
Pseudarcella campanula
Paratrochalina spinigera
Elphidium laeve
Eponidella sp.1.
Trochammina sp.1.
Quinqueloculina seminulum
Dentalina cf. ewaldi
Ammobaculites sp.2.
Glandulina laevigata
Quinqueloculina impressa
Miliolid Oost1
Triloculina trigonula
Quinqueloculina ludwigi
Quinqueloculina aff. carinata
Boggina subconica
Asterigerina brandhorstiana
Elphidium sp.4.
Paratrochalina inermis
Lagena cf. hexagona
Cibicides carinatus

Scale: 10 cms.= 40 ft.= 12·19 m.

M.Norvick. 1969.

FORAMINIFERAL RATIOS & DIVERSITY

CHRISTCHURCH BAY



LEGEND

60 - 30 FRACTION

- Agglutinated Foraminiferida
- Miliolacea
- *Elphidium spp. & Nonion spp.*
- *Nummulites spp.*
- All Other Rotaliina

1 *Reophax sp. 1.*
2 *Cribrostomoides pauperata*
3 *Ammobaculites sp. 2.*
4 *Ammobaculites sp. 1.*
5 *Trochammina sp. 1.*
6 Miliolid casts
7 *Quinqueloculina seminulum*
8 *Q. impressa*
9 *Q. ludwigi*
10 *Q. bicarinata*
11 All Other Miliolacea
12 *Q. aff. carinata*
13 *Q. costata*
14 *Pararotalia inermis*
O All Other Rotaliina

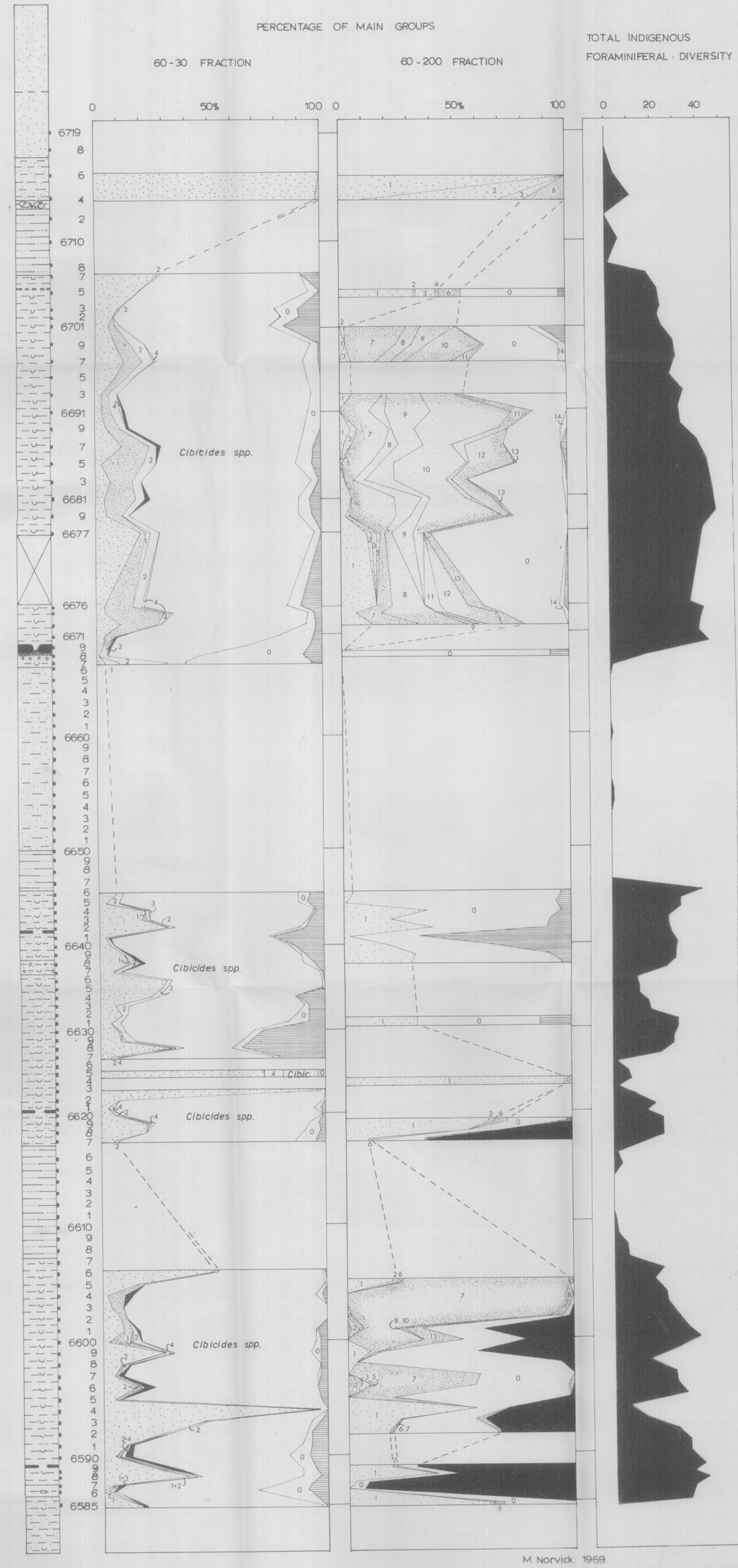
60 - 200 FRACTION

- Agglutinated Foraminiferida
- Miliolacea
- *Elphidium spp. & Nonion spp.*
- Globigerinacea
- All Other Rotaliina

1 Lagenacea (excluding Polymorphinids)
2 Polymorphinids
3 Buliminacea
4 Robertinacea
O All Other Rotaliina excluding *Cibicides*

Scale: 10 cms. = 40 ft. = 12·19 m.

ALUM BAY



M. Norvick. 1969.

TOTAL RANGES OF OSTRACODA

CHRISTCHURCH BAY

ALUM BAY

Scale: 10 cms.= 40 ft.= 12·19 m.

O = Casts & questionable specimens.

Indigenous Species

Diversity

0 10 20

Ostracod casts
Cytheridea (Cytheridea) intermedia
Leguminocythereis striatopunctata
Cytheretta laticosta
Pterygocythereis cornuta
Pterygocythereis fimbriata bartonensis
Schulerideа (Aequacytheridea) perforata
Cytherella munsteri
Paracypris contracta
Krithe bartonensis
Cyamocytheridea hebertiana
Quadracythere sp. 2.
Occultocythereis sp. 1.
Paijenborchella eocenica
Basquetina sp. 1.
Cytherella compressa
Cytherelloidea chewtonensis
Eucytherura cf. perforatina
Schizocythere batjezi
Trachyleberis (Trachyleberis) aculeata
Cytheropteron wetherelli
Cytheretta gracilicosta
Quadracythere? sp. 1.
Cytheropteron brimptoni
"Cytherura" cf. bambruggensis
Loxoconcha subovata
Cytheromorpha brabantica
Cuneocythere (Monsmirabilia) triebeli
Monoceratina sp. 1.
Cytheretta costellata
Reworked Cretaceous Ostracoda

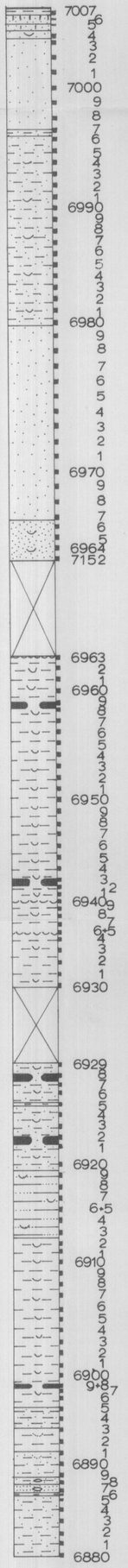
Reworked Cretaceous Ostracoda
Ostracod Casts
Cytheridea (Cytheridea) intermedia
Leguminocythereis striatopunctata
Cytheretta laticosta
Pterygocythereis cornuta
Pterygocythereis fimbriata bartonensis
Schulerideа (Aequacytheridea) perforata
Cytherella munsteri
Krithe bartonensis
Cytherella compressa
Occultocythereis sp. 1.
Cytheretta gracilicosta
Basquetina sp. 1.
Trachyleberis (Trachyleberis) aculeata
Paracypris contracta
Paijenborchella eocenica
Schizocythere batjezi
Cytheropteron brimptoni
Eucytherura cf. perforatina
Cuneocythere (Monsmirabilia) triebeli
Cyamocytheridea hebertiana
Quadracythere? sp. 1.
Cytheromorpha brabantica
Paracytheridea gradata
Loxoconcha subovata
Cytheropteron wetherelli
Quadracythere sp. 2.
"Cytherura" cf. bambruggensis
Cytheretta minor
Cytheretta costellata
Cytheretta sp. 9.
Monoceratina sp. 1.
Pterygocythereis pustulosa
Bairdoppilata cf. gliberti

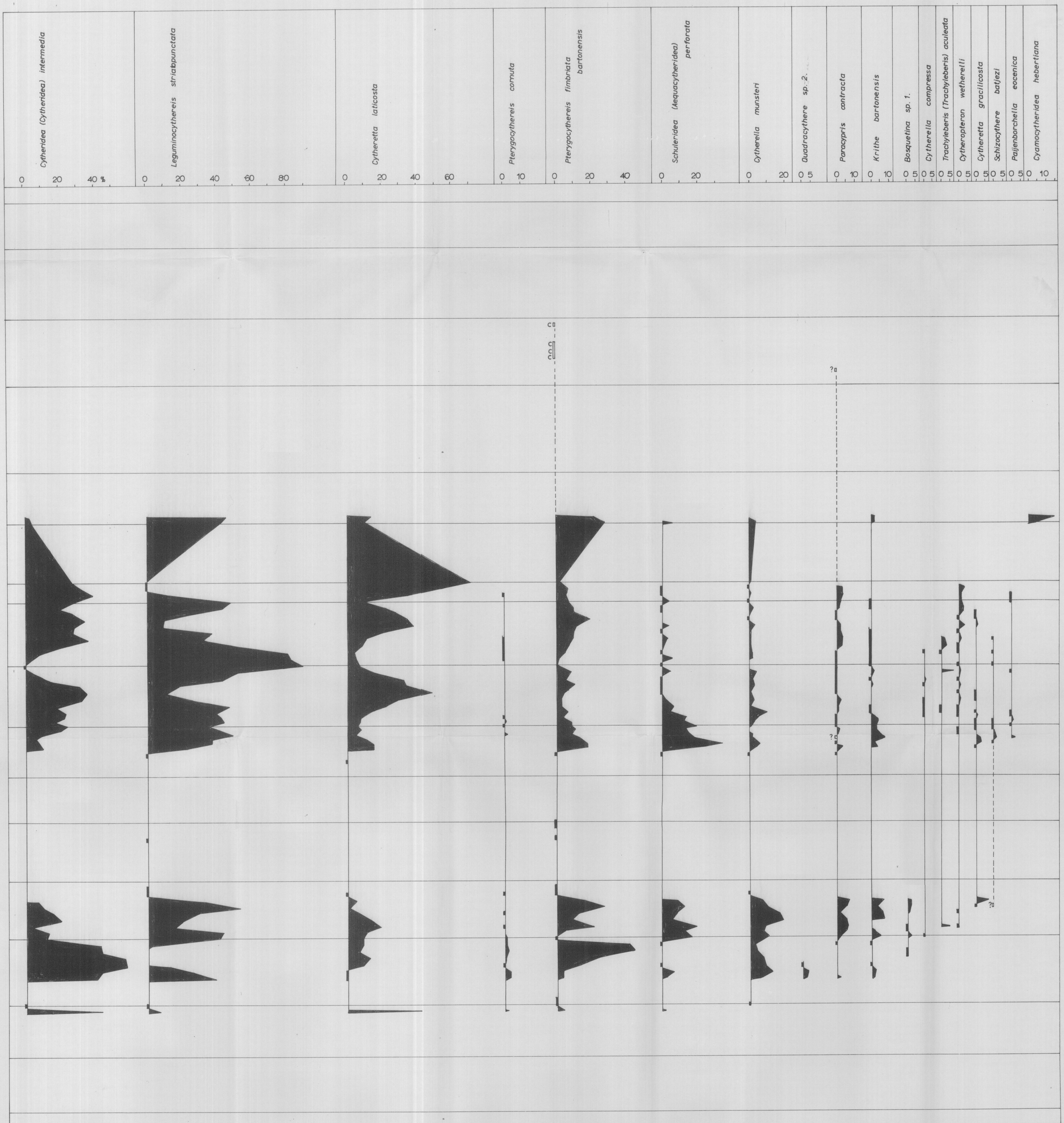
0 Indigenous Species
10 Diversity
20

M.Norvick. 1969.

PERCENTAGE DISTRIBUTION OSTRACODA IN 60-30 FRACTION : CHRISTCHURCH BAY

Sample no.	No. Ostracod valves counted	Total % plotted
7007	0	–
6	0	–
5	0	–
4	0	–
3	0	–
2	0	–
1	0	–
7000	0	–
9	0	–
8	0	–
7	0	–
6	0	–
5	0	–
4	0	–
3	0	–
2	0	–
1	2	–
6990	0	–
9	2	–
8	2	–
7	2	–
6	2	–
5	4	–
4	2	–
3	0	–
2	2	–
1	0	–
6980	0	–
9	0	–
8	0	–
7	0	–
6	0	–
5	0	–
4	0	–
3	0	–
2	0	–
1	0	–
6970	0	–
9	0	–
8	0	–
7	0	–
6	0	–
5	0	–
6964	94	100
7152	50	100
6963	98	100
2	558	98
1	631	98
6960	470	99
9	680	99
8	601	98
7	409	98
6	468	100
5	441	98
4	308	98
3	353	98
2	478	99
1	386	100
6950	684	97
9	305	99
8	401	98
7	290	100
6	332	100
5	312	99
4	425	98
3	285	98
2	194	98
1	282	99
6940	395	98
9	281	99
8	182	99
7	133	102
6·5	217	100
4	68	100
3	14	–
2	2	–
1	0	–
6930	0	–
9	2	–
8	1	–
7	0	–
6	21	–
5	0	–
4	0	–
3	0	–
2	0	–
1	0	–
6920	0	–
9	7	–
8	27	–
7	57	100
5·6	493	99
4	216	99
3	80	100
2	120	99
1	348	99
6910	388	100
9	409	98
8	553	100
7	366	99
6	128	100
5	272	100
4	208	98
3	0	–
2	0	–
1	4	–
6900	9	–
8·9	93	100
7	0	–
6	0	–
5	0	–
4	2	–
3	6	–
2	6	–
1	44	–
6890	2	–
9	0	–
8	0	–
7	0	–
6	0	–
5	0	–
4	0	–
3	0	–
2	0	–
1	0	–
6880	0	–





Scale: 10cms. = 40 ft. = 12·19 m.

M. Norvick. 1969.

PERCENTAGE DISTRIBUTION OSTACODA IN 60-30 FRACTION : ALUM BAY

Sample no.	No Ostracod valves counted	Total % plotted
6719	0	-
8	0	-
6	0	-
4	50	-
2	0	-
6710	14	-
8	0	-
7	19	-
5	142	99
3	135	96
2	445	97
6701	447	96
9	438	98
7	475	98
5	433	98
3	460	98
6691	509	100
9	465	99
7	448	98
5	465	97
3	323	98
6681	412	98
9	466	98
6677	427	97
6	437	96
5	437	97
3	457	97
6671	464	99
9	333	98
8	2	-
7	2	-
6	0	-
5	0	-
4	0	-
3	0	-
2	0	-
1	0	-
6660	0	-
9	0	-
8	0	-
7	0	-
6	0	-
5	0	=
4	0	-
3	0	-
2	0	-
1	0	-
6650	0	-
9	0	-
8	0	-
7	0	-
6	366	100
5	214	99
4	218	100
3	101	100
2	113	99
1	222	100
6640	112	99
9	123	99
8	106	98
7	14	-
6	0	-
5	4	-
4	2	-
3	0	-
2	0	-
1	31	-
6630	27	-
9	32	-
8	42	-
7	2	-
6	0	-
5	0	-
4	4	-
3	0	-
2	0	-
1	0	-
6620	6	-
9	9	-
8	56	100
7	77	99
6	0	-
5	0	-
4	0	-
3	0	-
2	0	-
1	0	-
6610	0	-
9	0	-
8	36	-
7	126	100
6	221	98
5	390	101
4	498	99
3	500	98
2	438	98
1	335	98
6600	330	97
9	235	99
8	150	99
7	369	99
6	424	96
5	432	99
4	33	-
3	54	101
2	56	101
1	259	99
6590	417	99
9	435	100
8	178	99
7	114	100
6	79	99
6585	137	99

Ostracod casts 0 20 40 60%

Cytheridea (Cytheridea) intermedia 0 20 40 60

Leguminocythereis striatopunctata 0 20 40 60

Cytheretta laticosta 0 20 40

Pterygocythereis cornuta 0 5

Pterygocythereis fimbriata bartonensis 0 20 40 60

Schuleridea (Aequacytheridea) perforata 0 20

Cytherella munsteri 0 10

Krithe bartonensis 0 5

Cytherella compressa 0 10

Bosquetina sp. 1. 0 10

Trachyleberis (Trachyleberis) aculeata 0 10

Cytheretta gracilicosta 0 5

Paracypris contracta 0 5

Cyamocytheridea hebertiana 0 10

Schizocythere batjesi 0 5

Cytheropteron wetherelli 0 5

Paijenborchella eocenica 0 5

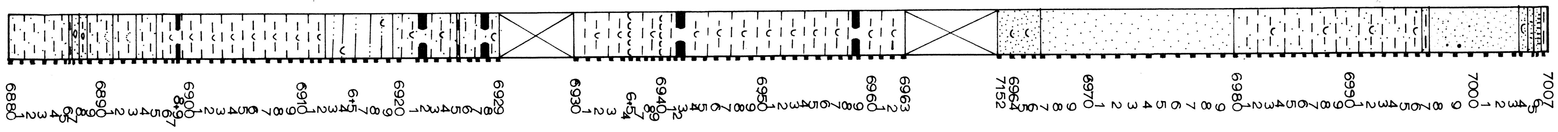
Cytheretta costellata 0 5

Pterygocythereis pustulosa 0 5

Scale: 10 cms. = 40 ft. = 12·19 m.

M. Norvick. 1969.

TOTAL RANGES OF MOLLUSCA IN THE BARTON BEDS OF CHRISTCHURCH BAY



Scale : 10cms = 40 ft. = 12·19 m. O = Casts, questionable & fragmentary specimens

PELECYPODA

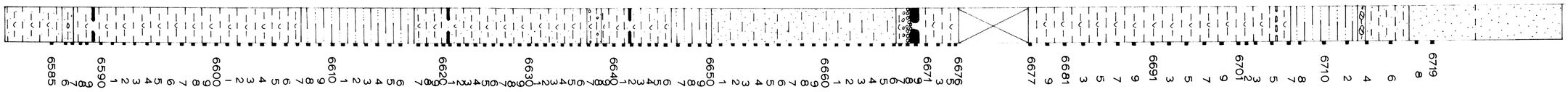
Lamellibranch Casts
Corbula pisum
Lutetia pisiformis
Venericardia sulcata
Nuculana minima
Pteria?sp.2.
Fossularca lissa
Nucula cf. bisulcata
Ostrea spp. (juveniles)
Erycina sp.1.
Nucula spp. (juveniles)
Crassatella sulcata
Myrtaea spinulosa
Barbatia appendiculata
Andara subglobulosa
Pteria? sp.1.
Meretricid Juvenile Type 1
Callista (Microcallista) heberti var. belgica
Meretricid Juvenile Type 2
Mactra cf. compressa
Cardium? sp.1.
Ostrea plicata
Limopsis scalaris
"Meretrix" sp.3.
Chlamys recondita
Corbula cf. costata
Lentidium sp. 1.
Psammobia ? sp. 1.
Anomia sp. 2.
Neaeroporomya argentea
Tellina ambigua
Corbula cuspidata
Glycymeris deleta
Nuculana striata
Venericardia oblonga
Lentidium tawneyi
Chama squammosa
Crassatella tenuisulcata
Venericardia spp. indet.
Crassatella spp. indet.
Divaricella rigaultiana
Nucula ampla
Tivelina gravida
Venericardia davidsoni
Solen sp. 1.
Corbicula deperdita
Trinacria curvirostris
Nucula cf. tumescens

GASTROPODA, SCAPHOPODA & CEPHALOPODA

Gastropod casts
Conomitra parva
Dentalium striatum
Skaptotion bartonense
Odostomia sp. 7.
Dentalium pellucens
Rissoa globulus
Calyptraea aperta
Naticids spp. (juveniles)
Aneurychilus sp. 1.
Syrnola polygyra
Crenilabium elongatum
Alvania bartonensis
Volvulella charlesworthi
Eulima sp. 1.
Sveltella microstoma
Ringicula parva
Belonidium eulimoides
Odostomia hordeola
Bullinella constricta
Mathildia bourdoti
Turrids spp. (juveniles)
Turbonilla pulchra
Odostomia sp. 1.
Odostomia miliola
Eulima sp. 2.
Marginella bifidoplicata
Hemipleurotoma callifera
Asthenotoma zonulata
Drillia formosa
Turritella spp. (juveniles)
Architectonica sp. 1.
Adeorbis elegans
Eopleurotoma? sp. 1.
Bonellitia evulsa
Acteon gardneri
Naticid opercula
Bela juncea
Rissoa sp.1.
Bullinella sp.3.
Bittium semigranosum
Euthriousus cf. regularis
Turrid sp.3.
Turrid sp.4.
Syrnola canaliculata
Turbonilla edwardsi
Hippochrenes amplus
Bittium sp.2.
Unitas nassaeformis
Syrnola excavata var.1.
Surcula cf. lanceolata
Murex cf. tricarinatus
Sycostoma pyrus
Surcula cf. attenuata
Bullinella coronata
Turrid sp.10.
Scala reticulata
Syrnola excavata
Fusinus porrectus
Rimella rimosa
Rostreulima macrostoma
Drillia innexa
Ancilla sp. 1.
Bittium terebrale
Dientomochilus bartonensis
Triforis? sp. 1.
Turrid sp. 15.
Acrilla sp. 1.
Mesalia sp. 4
Bullinella sowerbyi
Lacuna (Epheria) sp. 1.
Strebloceras cornuoides
Eulima munda
Teinostoma dubia
"Mitra" volutiformis
Gastropod gen. H sp.1.
Bathytoma turbida
Typhis pungens
Cerithioderma costulata
Turrid sp.11.
Xenophora sp.1.
Nautiloid siphuncle?
Odostomia sp.3.
Odostomia sp.8.
Asthenotoma conoides
Surcula sp.4.
Turrid sp.17.
Anisocycla sp.11.
Asthenotoma pupa
Asthenotoma biconus
Turrid sp.14.
Volutid spp. (juveniles)
Adeorbis sp.7.
Turrid sp.18.
Odostomia sp.2.
Adeorbis sp.8.
Bittium sp.5.
Odostomia sp.4.
Bullinella sp.5.
Unitas cf. elongata
Bayania hordacea
Batillaria concava
Potamides (Ptychopotamides) vagus

M. Norvick. 1969.

TOTAL RANGES OF MOLLUSCA IN THE BARTON BEDS OF ALUM BAY



Scale: 10 cms. = 40 ft. = 12·19 m. O = Casts, fragments & questionable specimens

PELECYPODA

Corbula pisum
Nuculana minima
Fossularca lissa
Nucula spp. (juveniles)
Venericardia sulcata
Pteria? sp.1.
Anisocardia pectinifera
Andara subglobulosa
Myrtaea spinulosa
Meretricid juvenile type 1.
Ostrea spp. (juveniles)
Lutetia pisiformis
Abra sp.1.
Crassatella sulcata
Lentidium sp.1.
Tellina cf. hantoniensis
Erycina? sp.2.
Pteria?sp. 2.
Barbatia appendiculata
Corbula cf. costata
Divaricella sp.
Bankia (Neobankia) cf. tumida
Meretricid juvenile type.2.
Tellina ambigua
Limopsis scalaris
Erycina? sp.3.
Erycina sp.1.
Neaeroporomya argentea
Chlamys recondita
Ostrea plicata
Nucula cf. bisulcata
Chama squammosa
Corbula cuspidata
Venericardia spp. indet.
Nuculana striata

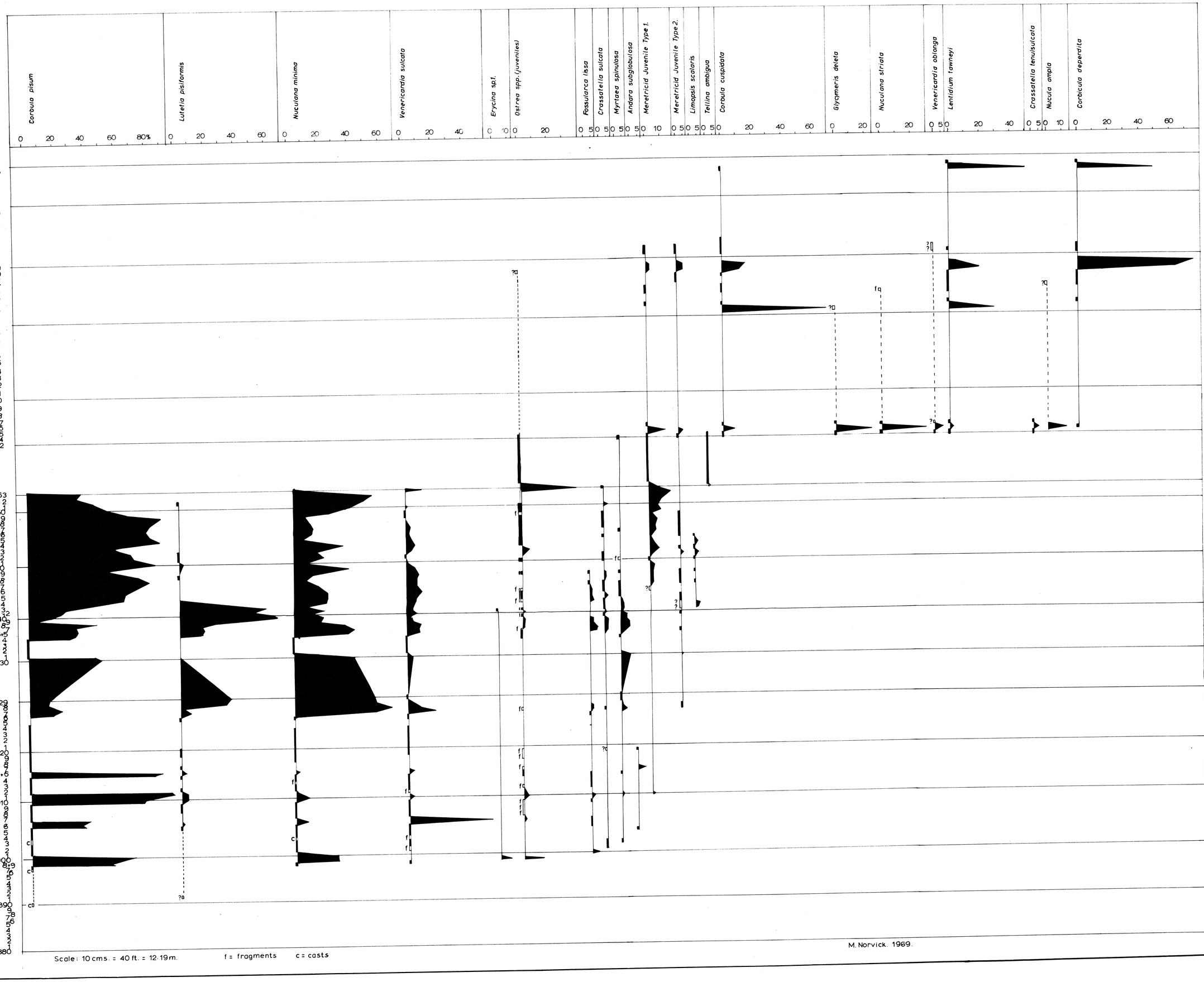
GASTROPODA & SCAPHOPODA

Turritella spp. (juveniles)
Dentalium pellucens
Odostomia sp.3.
Eulima sp.1.
Xenophora sp.1.
Conomitra parva
Syrnola canaliculata
Adeorbis elegans
Naticid spp. (juveniles)
Turrid spp. (juveniles)
Skaptotion bartonense
Bittium sp.3.
Odostomia sp. 7.
Marginella bifidoplicata
Rimella rimosa
Turrid sp.10.
Acteon gardneri
Rissoa globulus
Eulima sp.2.
Ringicula parva
Sveltella microstoma
Drillia formosa
Dentalium striatum
Odostomia miliola
Architectonica sp.1.
Turbonilla pulchra
Mathildia bourdoti
Belondinium eulimoides
"Mitra" volutiformis
Naticid opercula
Hemipleurotoma callifera
Bullinella coronata
Bullinella constricta
Turrid sp.4.
Odostomia hordeola
Teinostoma dubia
Turrid sp.3.
Ancilla sp.1.
Volvulella charlesworthi
Syrnola polygyra
Asthenotoma pupa
Rostreulima macrostoma
Asthenotoma zonulata
Calyptraea aperta
Unitas nassaeformis
Alvania bartonensis
Bonellitia evulsa
Crenilabium elongatum
Bittium semigranosum
Syrnola excavata
Bittium sp.2.
Akera striatella
Rissoa sp.1.
Thecopsella sp.1.
Syrnola excavata var.1.
Alvania sp 3
Sycostoma pyrus
Acrilla sp.1.
Drillia innexa
Surcula cf. attenuata
Cominella deserta
Turrid. sp.17.
Asthenotoma conoides
Strebloceras cornuoides
Mesalia sp4.
Aneurychilus sp.1.
Bullinella sowerbyi
Berthelinia cf. elegans
Surcula sp. 4.
Bullinella sp. 3.
Anisocycla sp. 11.
Gastropod gen. H. sp. 1.
Odostomia sp. 8
Triforis? sp. 1
Fusinus porrectus
Hippochrenes amplus
Bathytoma turbida
Typhis pungens
Euthriofusus cf. regularis
Lacuna (Epheria) sp 1
Turrid sp.21.
Cerithioderma costulatum
Odostomia sp.1.
Adeorbis sp.7
"Eopleurotoma" sp.1.
Scala reticulata
Scaphander? sp.1.
Asthehotoma biconus
Surcula rostrata
Turrid sp.20.
Turrid sp.14.
Turrid sp.15.
Turrid sp.18.
Volutid spp. (juveniles)
Bela juncea
Capulus squammaeformis
Coptostoma quadratum
Bithinia ? sp. 1.
Odostomia sp. 2.
Capulus sp. 2.

M. Norwick. 1969.

PERCENTAGE DISTRIBUTION OF PELECYPODA : 10 30 FRACTION : CHRISTCHURCH BAY

Sample nos	No. Pelecypod valves counted	Total % plotted
7007	0	-
6	0	-
5	x	-
4	362	100
3	0	-
2	0	-
1	0	-
7000	0	-
9	0	-
8	0	-
7	0	-
6	0	-
5	0	-
4	0	-
3	2	-
2	23	-
1	18	-
6990	x	-
9	193	101
8	158	100
7	12	-
6	5	-
5	10	-
4	8	-
3	0	-
2	11	-
1	91	99
6980	0	-
9	0	-
8	0	-
7	0	-
6	0	-
5	0	-
4	0	-
3	0	-
2	0	-
1	0	-
6970	0	-
9	0	-
8	0	-
7	0	-
6	0	-
5	14	-
6964	169	99
7152	33	-
3	294	100
2	272	100
1	391	100
6960	489	100
9	695	99
8	1219	99
7	575	99
6	1185	99
5	732	99
4	1053	99
3	143	100
2	241	99
1	250	98
6950	675	98
9	146	99
8	773	97
7	524	99
6	616	98
5	303	98
4	453	100
3	614	99
2	440	100
1	704	99
6940	298	100
9	266	97
8	245	101
7	181	101
5+6	423	99
4	157	99
3	31	-
2	3	-
1	28	-
6930	67	99
6929	301	99
8	128	99
7	77	100
6	157	99
5	9	-
4	1	-
3	4	-
2	19	-
1	27	-
6920	35	-
9	19	-
8	6	-
7	4	-
5+6	83	100
4	48	-
3	7	-
2	43	-
1	82	100
6910	97	99
9	31	-
8	24	-
7	22	-
6	135	98
5	45	-
4	39	-
3	0	-
2	34	-
1	18	-
6900	50	100
8+9	70	100
7	22	-
6	0	-
5	0	-
4	0	-
3	0	-
2	0	-
1	0	-
6890	0	-
9	0	-
8	0	-
7	0	-
6	0	-
6880-6885	0	-



Scale: 10 cms. = 40 ft. = 12·19 m.

f = fragments c = casts

M. Norvick. 1969.

PERCENTAGE DISTRIBUTION PELECYPODA : 10 30 FRACTION : ALUM BAY

18

Scale: 10 cms. = 40 ft. = 12·19 m.

Sample nos	No Pelecypod valves counted	Total % plotted
6719	0	–
8	0	–
6	0	–
4	x	–
2	0	–
6710	1	–
8	0	–
7	13	–
5	65	101
3	47	–
2	332	99
6701	129	99
9	481	99
7	64	101
5	499	100
3	496	98
6691	522	98
9	605	99
7	241	97
5	429	98
3	445	99
6681	458	99
9	268	97
6677	276	99
6676	658	99
5	568	98
3	519	98
6671	635	97
9	385	100
8	161	99
7	0	–
6	0	–
5	0	–
4	0	–
3	0	–
2	0	–
1	0	–
6660	0	–
9	0	–
8	0	–
7	0	–
6	0	–
5	0	–
4	0	–
3	0	–
2	0	–
1	0	–
6650	0	–
9	0	–
8	0	–
7	0	–
6	91	100
5	165	100
4	370	101
3	239	97
2	340	100
1	549	100
6640	551	99
9	183	99
8	161	99
7	298	99
6	142	98
5	138	99
4	171	99
3	144	98
2	281	98
1	294	98
6630	203	98
9	109	97
8	169	98
7	77	98
6	0	–
5	7	–
4	125	100
3	10	–
2	136	98
1	186	100
6620	175	99
9	16	–
8	84	99
7	83	98
6	0	–
5	0	–
4	0	–
3	0	–
2	0	–
1	0	–
6610	0	–
9	x	–
8	x	–
7	77	100
6	216	100
5	67	99
4	312	100
3	209	99
2	64	102
1	34	–
6600	68	98
9	113	97
8	53	101
7	124	98
6	43	–
5	611	98
4	16	–
3	49	–
2	92	100
1	1319	99
6590	1230	100
9	73	99
8	221	98
7	29	–
6	24	–
6585	67	–

Corbula pisum 0 20 40 60 80%

Nuculana minima 0 20 40

Fossularca lissa 0 5

Nucula spp. (juveniles) 0 5

Venericardia sulcata 0 20

Pteria? sp. 1. 0 5

Myrtaea spinulosa 0 10

Meretricid juvenile type 1. 0 5

Ostrea spp. (juveniles) 0 10

Lutetia pisiformis 0 20

Abra sp. 1. 0 5

Crassatella sulcata 0 5

Lentidium sp. 1. 0 5

Pteria? sp. 2. 0 5

Corbula cf. costata 0 5

Meretricid juvenile type 2. 0 5

Limopsis scalaris 0 5

Tellina ambigua 0 5

f = fragments. c = casts.

M.Norvick. 1969.

PERCENTAGE DISTRIBUTION OF GASTROPODA & SCAPHOPODA : 10-30 FRACTION : CHRISTCHURCH BAY

PLOTTED AS PERCENTAGE TOTAL MOLLUSCA

D = Fragments, casts & questionable specimens Scale: 10cms. = 40 ft. = 12.19 m.

Sample nos	Nos Gastropoda & Scaphopoda counted	Total Gast. & Scaphop. Bivalves
7007	x	-
6	x	-
4	437	71
3	0	-
2	0	-
7000	0	-
9	0	-
8	0	-
7	0	-
6	0	-
5	0	-
4	0	-
3	0	-
2	7	-
1	8	-
6990	0	-
9	14	14
8	16	16
7	8	-
6	5	-
5	1	-
4	0	-
3	2	-
2	1	-
1	0	-
6980	0	-
9	0	-
8	0	-
7	0	-
6	0	-
5	0	-
4	0	-
3	0	-
2	0	-
1	0	-
6970	0	-
9	0	-
8	0	-
7	0	-
6	0	-
5	1	-
6964	30	23
7152	11	-
3	1621	90
2	272	61
1	180	43
6960	192	37
9	166	27
8	240	24
7	148	30
6	228	23
5	156	25
4	238	25
3	70	48
2	264	61
1	55	30
6950	79	15
9	44	32
8	168	30
7	93	21
6	204	35
5	112	40
4	194	42
3	263	37
2	180	37
1	258	36
6940	146	38
9	108	38
8	133	49
7	135	51
5+6	239	46
4	78	45
3	8	-
2	1	-
1	7	-
6930	13	-
6929	35	15
8	20	22
7	14	28
6	72	44
5	2	-
4	0	-
3	0	-
2	0	-
1	1	-
6920	3	-
9	12	-
8	10	-
7	13	-
5+6	164	77
4	25	-
3	6	-
2	75	75
1	39	45
6910	108	60
9	24	-
8	7	-
7	21	-
6	257	73
5	49	66
4	36	65
3	3	-
2	14	-
1	30	-
6900	29	55
8+9	47	53
7	18	-
6	x	-
5	x	-
4	x	-
3	x	-
2	x	-
1	x	-
6890	0	-
9	0	-
8	0	-
7	0	-
6	0	-
6880 - 6885	0	-

Conomitra parva
Odostomia sp.?.
Dentalium pelluens
Rissoa globulus
Dentalium striatum
Skaptotion bartonense
Naticids spp.(juveniles)
Crenilabium elongatum
Alvania bartonensis
Valvulella charlesworthi
Eulima sp.1.
Svelteila microstoma
Ringicula parva
Odostomia hordeola
Bullinella constricta
Turbonilla pulchra
Marginella bifidaplicata
Hemipleurotoma callifera
Cymola polygyra
Asthenotoma zonulata
Odostomia miliola
Drillia formosa
Turrid spp.(juveniles)
Epipleurotoma sp.1.
Acteon gardneri
Turritella spp.(juveniles)
Belonidium eulimoides
Bullinella sp.3.
Rissoa sp.1.
Turrid sp.4.
Archetectonica sp.1.
Hippochrenes amplus
Surcula cf. lanceolata
Cymola canaliculata
Bittium semigranosum
Bittium sp.2.
Aporrhais elegans
Cymola excavata var.1.
Aneurychilus sp.1.
Turrid sp.10.
Scala reticulata
Cymola excavata
Fusinus perrectus
Rimella rimosa
Bullinella coronata
Bittium terebrale
Acirsa sp.1.
Mesalia sp.4.
Bullinella sowerbyi
Lacuna (Epheria) sp.1.
Calyptraea aperta
Xenophora sp.1.
Odostomia sp.3.
Turrid sp.14.
Bullinella sp.5.
Unitas cf. elongata
Bayana hordacea

M.Norvick. 1969.

PERCENTAGE DISTRIBUTION OF GASTROPODA & SCAPHOPODA : 10-30 FRACTION : ALUM BAY

PLOTTED AS PERCENTAGES OF TOTAL MOLLUSCA

c = casts f = fragments

Sample nos	Total Gastropoda & Scaphopoda	Total % Gastr. & Scaph. plotted
6719	0	-
8	0	-
6	0	-
4	0	-
2	0	-
6710	6	-
8	0	-
7	97	94
5	25	43
3	705	95
2	364	62
6701	365	75
9	222	44
7	38	53
5	99	22
3	94	19
6691	130	27
9	85	16
7	42	23
5	139	32
3	98	24
6681	117	25
9	135	41
6677	65	26
6676	220	34
5	151	27
3	168	32
6671	136	19
9	149	33
8	23	23
7	x	x
6	0	-
5	0	-
4	0	-
3	0	-
2	0	-
1	0	-
6660	0	-
9	0	-
8	0	-
7	0	-
6	0	-
5	0	-
4	0	-
3	0	-
2	0	-
1	0	-
6650	0	-
9	0	-
8	0	-
7	0	-
6	49	50
5	74	41
4	37	12
3	29	16
2	36	12
1	37	8
6640	19	4
9	34	22
8	25	21
7	32	18
6	3	3
5	2	2
4	8	8
3	7	9
2	34	16
1	35	15
6630	23	13
9	42	42
8	66	38
7	29	40
6	0	-
5	2	-
4	3	5
3	x	-
2	4	4
1	6	6
6620	5	5
9	5	-
8	28	39
7	60	60
6	0	-
5	0	-
4	0	-
3	0	-
2	0	-
1	0	-
6610	0	-
9	0	-
8	3	-
7	17	31
6	128	54
5	37	50
4	72	24
3	73	36
2	29	49
1	47	76
6600	94	67
9	89	54
8	17	-
7	60	43
6	25	-
5	97	19
4	11	-
3	10	-
2	13	21
1	185	15
6590	168	13
9	33	45
8	78	38
7	23	-
6	3	-
6585	8	-

Turritella spp. (juveniles)
Dentalium pellucens
Odostomia sp. 3.
Eulima sp.1.
Xenophora sp.1.
Conomitra parva
Synnola canaliculata
Adeorbis elegans
Naticid spp. (juveniles)
Turrid spp. (juveniles)
Skaptalion bartonense
Odostomia sp. 7.
Marginella bifidoplicata
Rimella rimosa
Turrid sp.10.
Acteon gardneri
Rissoa globulus
Ringicula parva
Sveltella microstoma
Drillia formosa
Dentalium striatum
Odostomia miliola
Architectonica sp.1.
Turbonilla pulchra
Mathildia bourdoti
Belondinium eulimoides
Naticid opercula
Hemipleurotoma callifera
Bullinella coronata
Bullinella constricta
Turrid sp.4.
Odostomia hortaeola
Teinostoma dubia
Turrid sp.3.
Ancilla sp.1.
Valvulella charlesworthi
Synnola polygyra
Asthenotoma pupa
Alvania bartonensis
Crenilabium elongatum
Bittium sp.2.
Rissoa sp.1.
Synnola excavata var.1.
Alvania sp.3.
Acrilla sp.1.
Turrid sp.17.
Mesalia sp.4.
Bullinella sowerbyi
Surcula sp.4.
Odostomia sp.8.
Aneurychilus sp. 1
Fusinus porrectus
"Eopleurotoma"? sp.1.

M. Norvick. 1969.

RANGES AND RATIOS OF MICROPLANKTON IN THE BARTON BEDS : CHRISTCHURCH BAY

Sample nos	No Microplankton counted in <60 fr. (nc = not counted)	Examined qualitatively
7007	0	X
6	nc	X
5	0	X
4	0	X
3	0	X
2	0	X
1	0	X
7000	0	X
9	0	X
8	nc	X
7	nc	X
6	270	X
5	336	X
4	336	X
3	419	X
2	348	X
1	518	X
6990	208	X
9	0	X
8	nc	X
7	nc	X
6	270	X
5	281	X
4	248	X
3	167	X
2	83	X
1	227	X
6980	228	X
9	51	X
8	nc	X
7	nc	X
6	nc	X
5	nc	X
4	nc	X
3	nc	X
2	nc	X
1	nc	X
6970	nc	X
9	nc	X
8	nc	X
7	nc	X
6	nc	X
5	nc	X
4	nc	X
3	nc	X
2	nc	X
1	nc	X
6960	2	X
9	8	X
8	12	X
7	32	X
6	42	X
5	46	X
4	42	X
3	108	X
2	174	X
1	195	X
6940	455	X
9	326	X
8	209	X
7	97	X
5+6	250	X
4	98	X
3	170	X
2	249	X
1	138	X
6930	249	X
9	113	X
8	273	X
7	143	X
6	215	X
5	283	X
4	31	X
3	25	X
2	137	X
6920	194	X
1	15	X
9	191	X
8	259	X
7	159	X
5+6	189	X
4	219	X
3	122	X
2	279	X
1	317	X
6910	219	X
9	68	X
8	58	X
7	273	X
6	179	X
5	353	X
4	275	X
3	53	X
2	113	X
1	87	X
6900	261	X
9	92	X
8		X
7	83	X
6	90	X
5	24	X
4	82	X
3	137	X
2	65	X
1	128	X
6890	17	X
9	34	X
8	20	X
7	12	X
6	10	X
5	5	X
4	1	X
3	5	X
2	42	X
1	45	X
6880	104	X

Formations below (in litt.)

6880 6890 6900 6910 6920 6930 6940 6950 6960 6970 6980 6990 7000 7007 7152 6964 6963

Formations above (in litt.)

Scale: 10 cms. = 40 ft. = 12.19m.

O = Questionable specimens

DINOFLAGELLATE CYSTS

- *Areoligera sp.1.*
- *Cleistosphaeridium centrocarpum*
- *Homotryblium pallidum*
- *Thalassiphora pelagica*
- *Pelmnickia sp.1.*
- *Adnatosphaeridium sp.1.*
- *Cordosphaeridium inodes*
- *W. (Rhombodinium) sp.1.*
- *Cordosphaeridium gracilis*
- *Hystrichosphaeridium salpingophorum*
- *Oligosphaeridium dictyoplokus*
- *Hystrichosphaeridium aff. latirictum*
- *Deflandrea phosphoritica*
- *Achmosphaera alcicornu*
- *Hystrichosphaera ramosa var. indet.*
- *Dinoflagellate incertae sedis sp.1.*
- *Hystrichokolpoma biformoides*
- *Hystrichokolpoma eisenacki*
- *Hystrichosphaera ramosa var. membranacea*
- *Kenleyia? sp.1.*
- *Deflandrea wetzeli*
- *Wetzeliella (W.) articulata*
- *Polysphaeridium subtile*
- *Hystrichosphaeridium sp.1.*
- *Oligosphaeridium sp.1.*
- *Lanternosphaeridium axialis*
- *Hystrichosphaera crassipellis*
- *Achmosphaera ramulifera*
- *Wetzeliella (W.) cf. reticulata*

TASMANITIDS

- *Pytthodiscus chondrotus*
- *Leiosphaeridia ralla*
- *Leiosphaeridia ? sp.3.*
- *Leiosphaeridia sp.2.*
- *Tasmanites suevicus*
- *Tasmanites sp.1.*
- *Pterospermopsis cf. danica*
- *Tasmanites sp.2.*

INCERTAE SEDIS

- *Resin*
- *Oudhkusumites cf. foveolatus*
- *Incertae sedis sp.1.*
- *Spores*
- *Incertae sedis sp.2.*
- *Incertae sedis sp.3.*

REWORKED ELEMENTS

- *Reworked Cretaceous Gonyaulacysta*
- *Reworked Upper Palaeozoic Calamospora*

QUANTITATIVE DATA

INDIGENOUS SPECIES DIVERSITY OF DINOFLAGELLATE CYSTS & TASMANITIDS (0, 10)

LOCAL LOSSES & GAINS GRAPH (DINOFLAGELLATES) (0, 10)
Adaptive sections
Inadaptive sections

% DISTRIBUTION OF TOTAL MICROPLANKTON (0, 50%, 100)
Wetzeliella spp.
Thalassiphora spp.
All other Dinoflagellates
Tasmanitids

% DISTRIBUTION MICROPLANKTON / BENTHONIC FORAMINIFERIDA + MICROPLANKTON (0, %, 100)

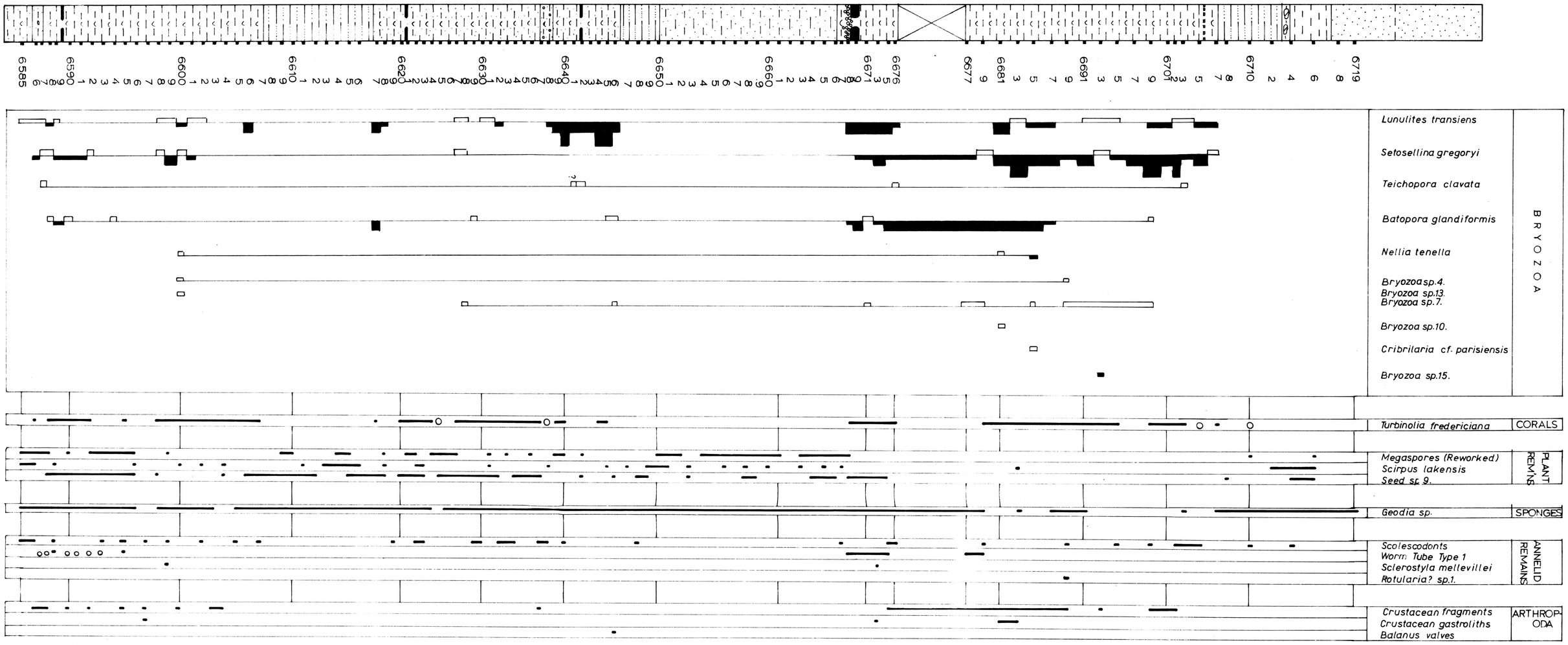
M. Norvick. 1969.

RANGES & RATIOS OF MICROPLANKTON IN THE BARTON BEDS : ALUM BAY

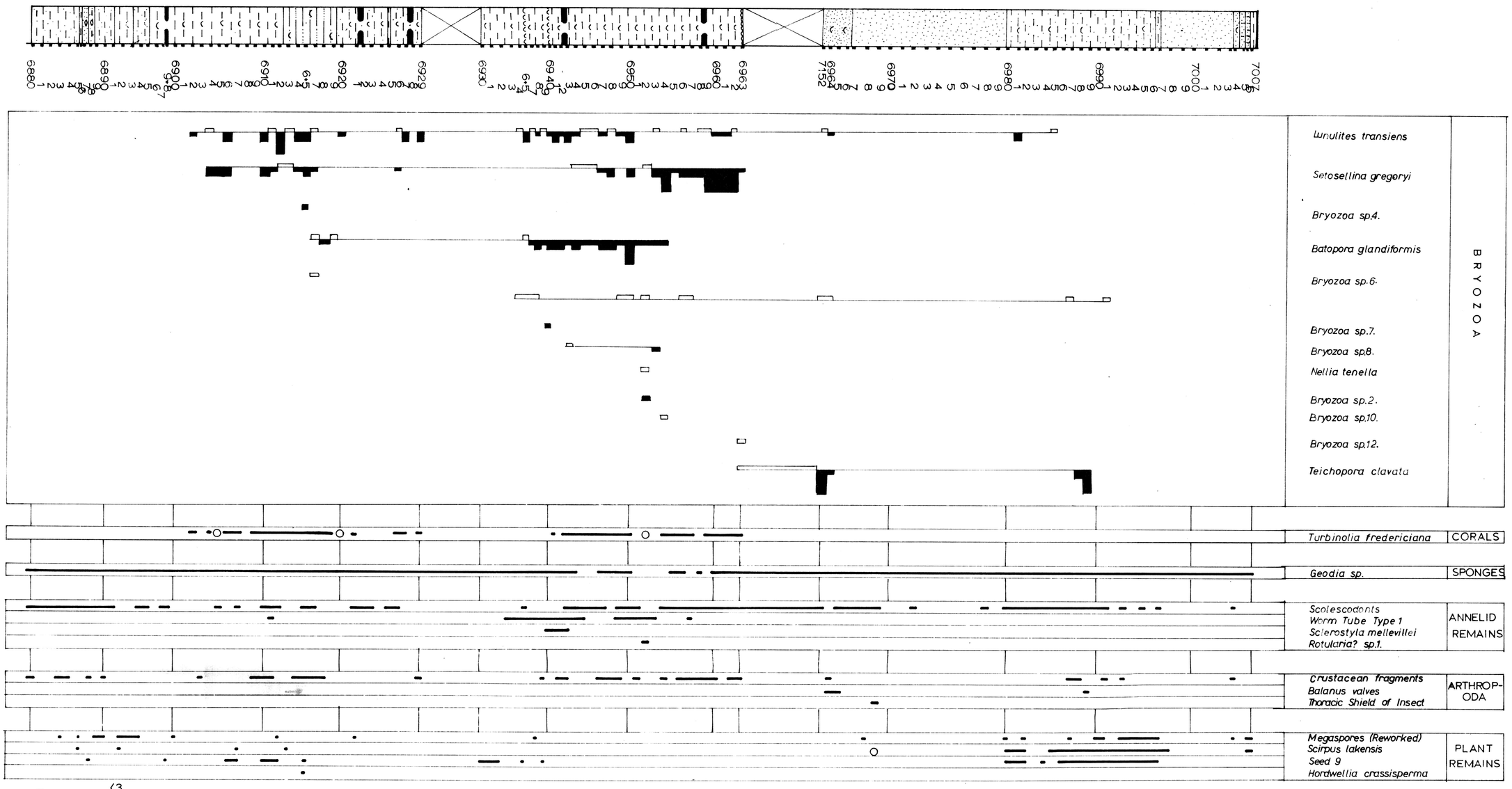
Sample nos	6719	6710	6701	6691	6681	6677	6671	6660	6650	6640	6630	6620	6610	6600	6590	6585
No Microplankton counted in (60 fr. (nc= not counted)	0	nc	2	8	148	185	109	182	164	133	94	120	183	85	210	76	295	70	160	143	324	285	170	93	52	128	105	583	414	263	135	22	18	495	159	200	33	264	152	242	163	319	355	354	253	25	35	285	54	352	107	424	135	278	317	324	29	227
Examined qualitatively	x	x	x

RANGES OF SMALL GROUPS IN THE BARTON BEDS

ALUM BAY



CHRISTCHURCH BAY



Scale : 10cms. = 40 ft. = 12.19m.

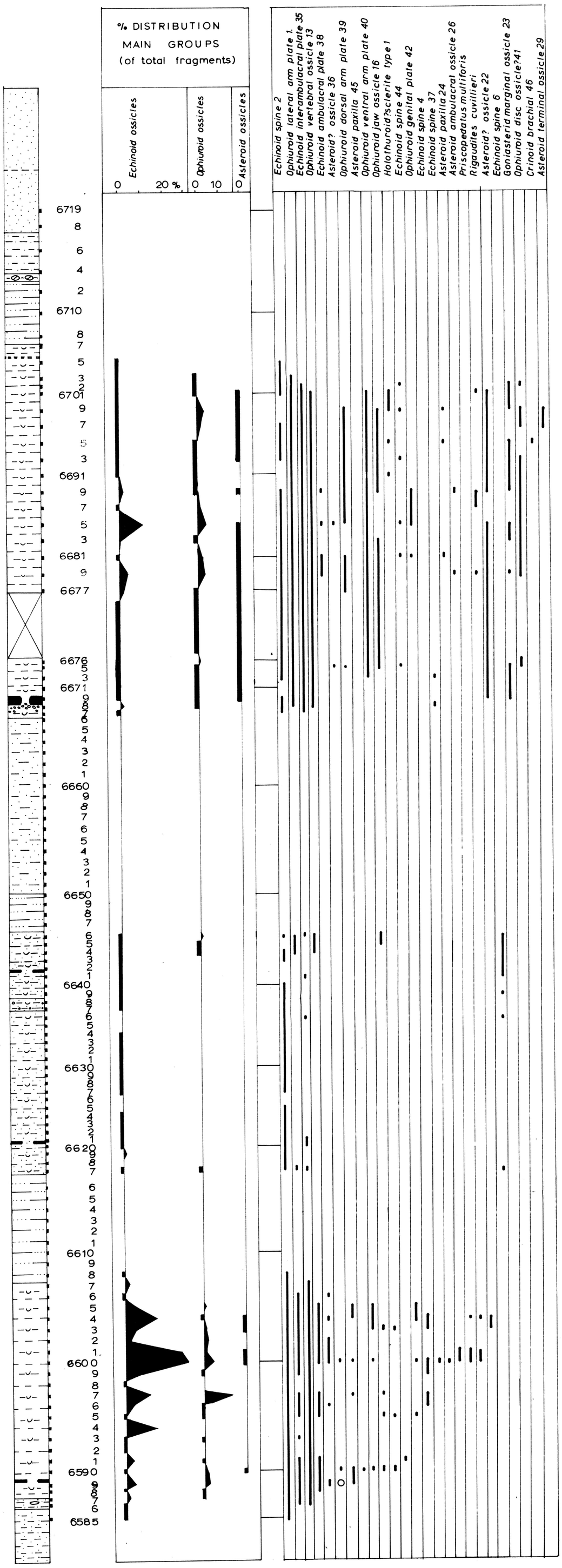
O = Questionable specimens

<3
3-9
10-50
>50

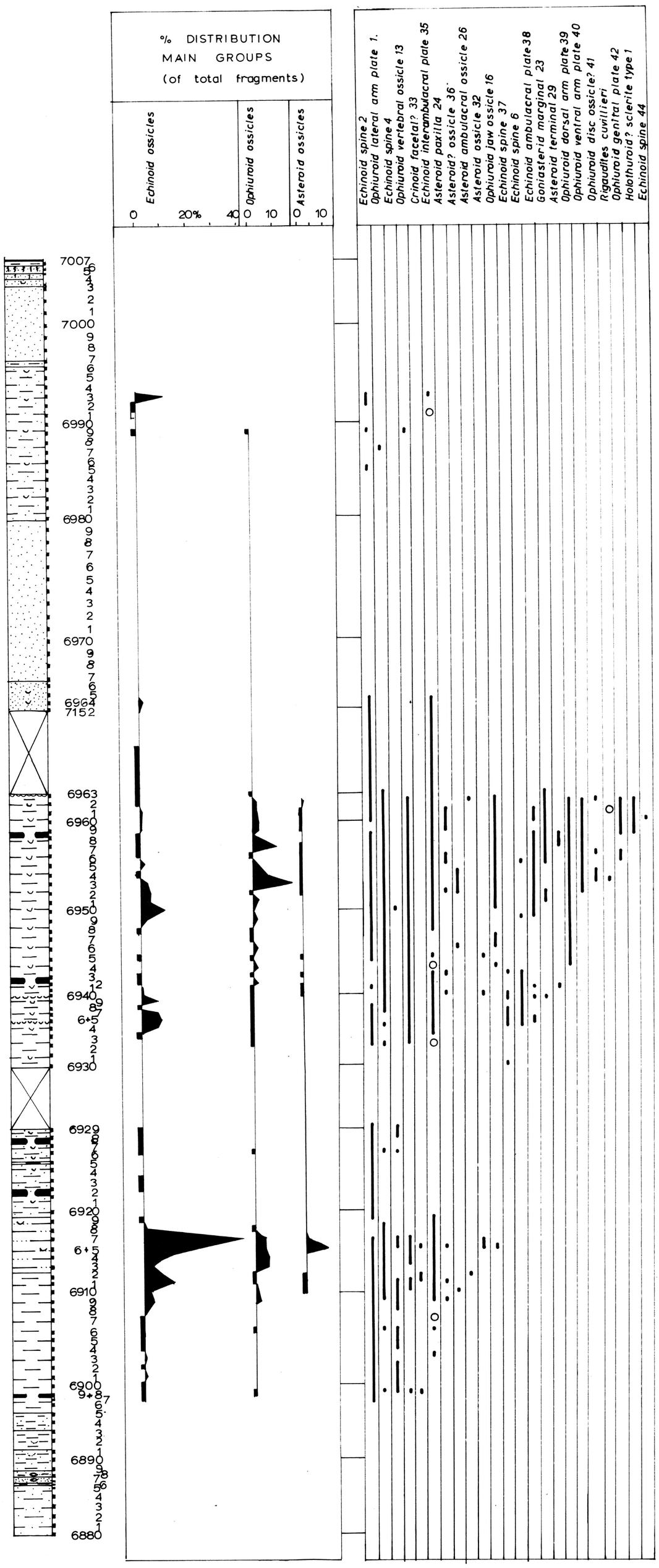
Specimens of Bryozoan zoarial fragments in any one size fraction

RANGES OF ECHINODERM OSSICLES IN THE BARTON BEDS

ALUM BAY



CHRISTCHURCH BAY



O = Questionable specimens

Scale : 10cms = 40 ft. = 12·19m.

M. Norvick. 1969.

RANGES OF VERTEBRATE REMAINS IN THE BARTON BEDS OF CHRISTCHURCH BAY

Scale: 10 cms. = 40 ft. = 12.19 m. O = questionable & fragmentary specimens.

TELEOST OTOLITHS

- *Otolith fragments*
- *Neobythites waltoni*
- *Apogon bellovacinus*
- *Indeterminate Otoliths*
- *Bathycongor sp.*
- *Antheas nota*
- *Solea bartonensis*
- *Pterothrissus bartonensis*
- *Bregmaceros minimus*
- *Cepola pantanelli*
- *Lutianus concavus*
- *Argentina hantoniensis*
- *Genypterus bartonensis*
- *Trachichthodes circularis*
- *Beryx lericheri*
- *Gadus dimidiatus*
- *Plesiops sp.*
- *Muraenesox eocenicus*
- *Ogilbia subregularis*
- *Hilsa regularis*
- *Merluccius shepherdi*
- *Otolith sp.39.*
- *Synodus rectus*
- *Callionymus sp.*
- *Citharichthys helectaroides*
- *Otolith sp.46.*
- *Muraenesox ovatus*
- *Peristedion denticulatus*
- *Otolith sp.2.*

TEETH & SCALES

- *Tooth 2*
- *Tooth 3*
- *Dermal denticle 5*
- *Tooth 2*
- *Tooth 4*
- *Scale 14*
- *Scale 4*
- *Dermal denticle 15*
- *Tooth 17*
- *Tooth 18*
- *Scale 1*
- *Dermal denticle 20*
- *Scale 16*
- *Dermal denticle 22*
- *Tooth 28*
- *Tooth 31*
- *Tooth 32*
- *Tooth 33*
- *Scale 21*
- *Tooth 34*
- *Dermal denticle 37*

specimens in any one size fraction

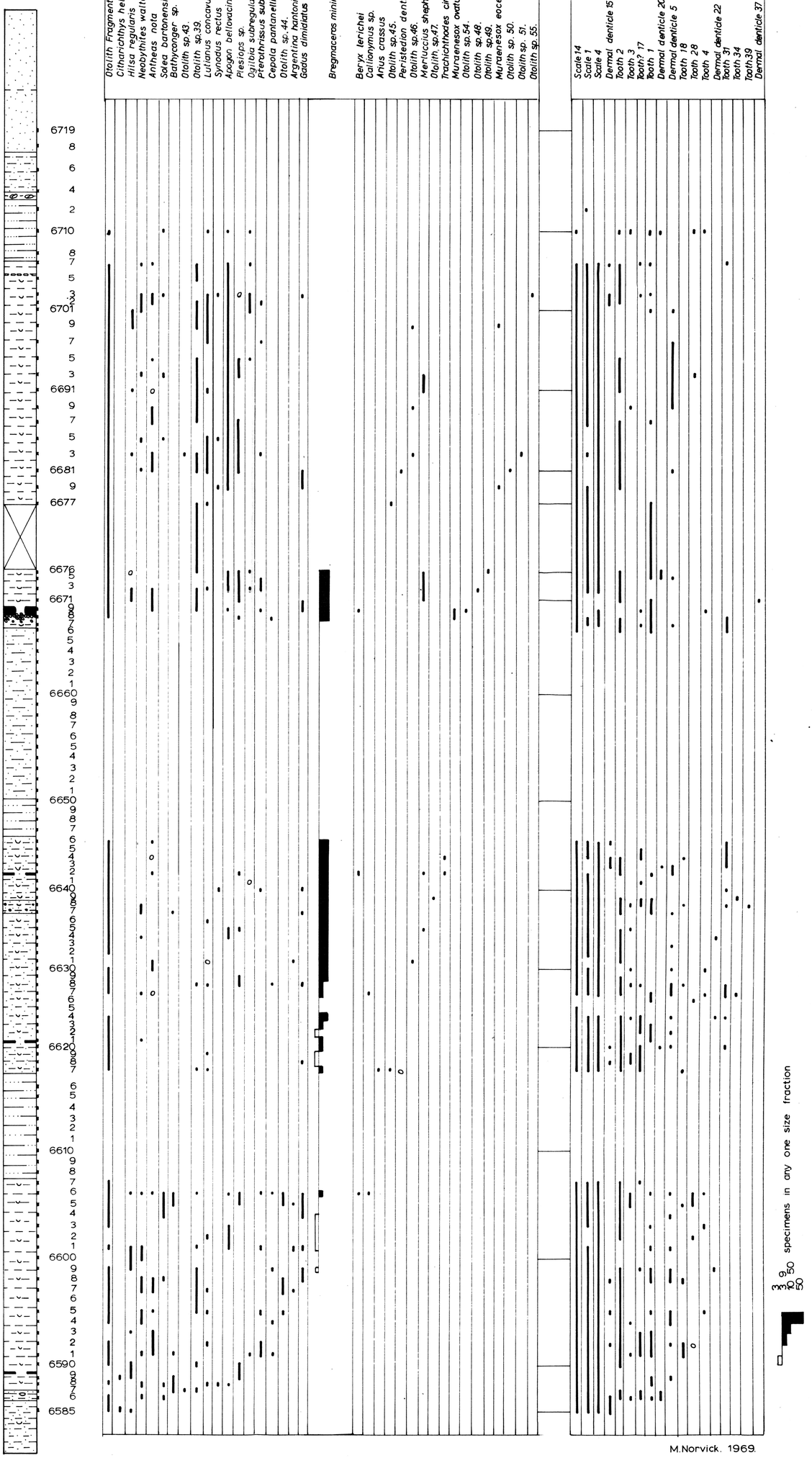
<13
3 9
10 50
>50

M. Norvick. 1969.

RANGES OF VERTEBRATE REMAINS IN THE BARTON BEDS OF ALUM BAY

o = questionable & fragmentary specimens

Scale: 10 cms. = 40 ft. = 12·19 m.



M. Norvick. 1969.

BIOFACIES ZONATION OF THE BARTON BEDS: CHRISTCHURCH BAY

Foraminiferida

BASE OF HIGHS	TOP OF HIGHS	ZONATION
	Pararotalia inermis	5b-e
	Cibicides vialovi	5a
Pararotalia inermis	*Miliolids*	4d
	Q. bicarinata	
	Q. ludwigi	4c
	Q. costata, Q. aff. carinata	
Q. aff. carinata, T. trigonula	*C. tenellus*	
Q. seminulum, Q. bicarinata	*G. gibba*	
C. pygmeus, C. tenellus, N. affine	*C. pygmeus, N. affine*	4b
	N. graniferum	
	Q. impressa, Q. aff. carinata	
Q. costata	*C. tenellus, A. brandhorstiana*	
Q. aff. carinata, Q. impressa	*E. latidorsatum, E. sp. 4.*	4a
E. latidorsatum, N. graniferum	*N. affine*	
E. sp. 4, G. laevigata	*Guttulina problema*	
A. brandhorstiana		
Q. ludwigi		
		3c
Cibicides tenellus		
Cibicides vialovi, Non. affine		3a
	Nummulites rectus	2d
	C. pygmeus, Q. seminulum, Q. impressa	2c
Q. seminulum	*Cib. ungerianus*	2b
Cib. ungerianus		
Nummulites rectus		2a
	Elphidium latidorsatum	
Cibicides pygmeus etc.	*Agglutinated Forams*	2a'
	N. prestwichianus	2a''
N. prestwichianus		1F

Pelecypoda

BASE OF HIGHS	TOP OF HIGHS	ZONATION
	L. tawneyi, C. deperdita	5e
	C. cuspidata, Meretrix sp.1.	5d
		5c
C. deperdita		
L. tawneyi		5b
	G. deleta, V. oblonga, N. ampla	
	Ostrea spp., Tellina ambigua	5a
C. cuspidata, G. deleta, N. striata, V. oblonga, N. ampla, Ch. squammosa	*N. minima, V. sulcata, C. pisum*	4d
Ostrea spp., T. ambigua		4c'''
Nuculana minima	*V. sulcata*	4c''
	Limopsis scalaris	4c'
	Lutetia pisiformis	4c
Lutetia pisiformis	*F. lissa*	4b''
Meretrix sp.1.		4b'
	Lutetia pisiformis, Myrtaea spinulosa	4b
Limopsis scalaris		4a''
	Nuculana minima	4a'
		4a
Lutetia pisiformis, N. minima, M. spinulosa		3c
		2+3a P
Nuculana minima		
C. pisum, V. sulcata, N. minima.		2d
		D

Gastropoda & Scaphopoda

BASE OF HIGHS	TOP OF HIGHS	ZONATION
	Bayania hordacea	5e
	Bullinella sp.5., R. globulus	5d
	C. aperta	
Bayania hordacea		5c
Bullinella sp.5.		5a + b
	Bittium sp.1.	
C. aperta	*D. pellucens, Turritella spp. Eopleurotoma? sp.1. A. elegans, Architectonica sp.1*	4d
	Triforis? sp.1.	4c'''
Eopleurotoma? sp. 1(B)	*M. bifidoplicata*	4c''
Eopleurotoma? sp. 1 (A) Architectonica sp.1, A. elegans	*Xenophora sp. 1.*	4c'
Turritella spp.		4c
	D. formosa, Odostomia sp. 3	4b''
	Sveltella microstoma	4b'
M. bifidoplicata	*Naticids, Acrilla sp.1. H. amplus*	4b
S. microstoma, Odostomia sp.3, Xenophora sp.1, Naticids, D. formosa, H. amplus, Triforis? 1		4a''
		4a'
		4a
D. pellucens, Acrilla sp.1.		3c
		3a
D. pellucens, Naticids, A. bartonensis, M. bifidoplicata, Turritella spp.		2d
S. canaliculata, Turritella spp.	*M. bourdoti*	2c
Turritella spp., M. bifidoplicata, M. bartonensis, R. globulus, M. bourdoti		2a
Naticids, D. pellucens.		D

Other Groups

BASE OF HIGHS	TOP OF HIGHS
	Teichopora clavata
	Balanus fragments
Balanus fragments	
Teichopora clavata	
	Setosellina gregoryi
	Crustacean frags
Crustacean frags	*Batopora glandiformis*
S. gregoryi	*Worm Tube type 1*
Worm Tube type 1	*Breg. minimus, Plant debris*
	Worm Tube type 1
Batopora glandiformis, Worm Tube type 1	
	Vertebrate debris
Vertebrate debris	
Bregmaceros minimus	*Vertebrate debris*
Vertebrate debris	
	Vertebrate debris

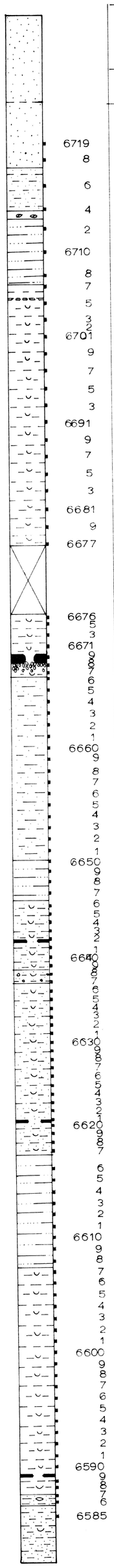
Composite Zonation

5e	*T. B. hordacea, C. deperdita, L. tawneyi.*
5d	*T. C. cuspidata, Bullinella sp. 5, R. globulus*
5c	
	B. C. deperdita, Bullinella sp.5, L. tawneyi
5b	
	T. G. deleta, V. oblonga, N. ampla, Balanus sp.
5a	*B. N. striata, etc, C. squammosa.*
	T. {V. sulcata, Eopleurotoma sp. 1, A. elegans, D. pellucens
4d	*B. P. inermis, Ostrea, T. ambigua*
	T. Miliolids, S. gregoryi, Triforis? sp.1.
4c'''	*B. Eopleurotoma? sp. 1. (B)*
4c''	*B. Eopleurotoma? sp. 1. (A)*
4c'	*T. L. scalaris, B. glandiformis*
4c	*B. Turritella spp.*
4b''	*T. C. pygmeus, N. affine, L. pisiformis, Microplankton*
4b'	*B. C. pygmeus, N. affine, C. tenellus*
4b	*T. F. lissa, D. formosa*
4a''	*T. C. tenellus, A. brandhorstiana, L. pisiformis, Worm Tube type 1*
4a'	
4a	
3c	*B. E. sp. 4, Q. ludwigi, D. formosa, H. amplus, A. brandhorstiana*
3a	*B. {C. vialovi, N. affine, L. pisiformis; N. minima, M. spinulosa, Acrilla sp.1; D. pellucens, B. minimus*
2d	*T. Nummulites rectus*
2c	*B. Turritella spp.*
2a	*B. {N. rectus, Alv. bartonensis, R. globulus, M. bourdoti*
2a''	*B. Cibicides pygmeus*
2a'	*T. Agglutinated Foraminiferida*
2a	
1	*T. N. prestwichianus (casts)*
	B. N. prestwichianus (casts)

D = Decalcified sequences G. = Sample gaps Scale : 10 cms. = 40 ft. = 12·19 m.

M. Norvick. 1969.

BIOFACIES ZONATION OF THE BARTON BEDS: ALUM BAY



Foraminiferida

Base of Highs	Top of Highs	Zonation
		5b?
		5a?
Agglutinated Foraminifera		
	Elph. latidorsatum	
	Q. ludwigi	
Elph. latidorsatum		
		4c
	Elph. latidorsatum } Q. aff. carinata	
		4b
Q. bicarinata	Q. costata	
Q. ludwigi	Non graniferum Q. impressa }	
Q. seminulum Q. impressa, Q. costata	Ast. brandhorstiana Cib. tenellus	4a
Non graniferum Elph. latidorsatum A. brandhorstiana }		
	Elph. sp. 4. etc.	3c
Cib. tenellus, Elph. sp. 4		
	Non affine, Elph. latidorsatum }	3b
	Baggina subconica	
Elph. latidorsatum Cib. vialovi Non affine	Cib. pygmeus	
	Reophax sp. 1.	3a
	Numm. rectus Cib. ungerianus	2d
Baggina subconica etc.		
	Calcareous spp. (Q. seminulum) }	2c
Reophax sp. 1.		
	Elph. latidorsatum	
Cib. ungerianus Q. seminulum	Reophax sp. 1.	2b
Numm. rectus	Non affine Numm. prestwichianus }	2a
Non affine E. latidorsatum Numm prestwichianus }		1F

5b? D
5a? 5F
4c 4F
4b G
4a
D
3c
3b 3F
3a
2d
D
2c
2F
2b
2a
1F

Pelecypoda

Base of Highs	Top of Highs	Zonation
		5b?
	C. pisum, N. minima etc. }	5a
	Chama squammosa	5P
	Ostrea spp.	
		4c +d
Nuculana minima Ostrea spp.		
	Ven sulcata Cr. sulcata Limopsis scalaris }	4P
	T. range L. pisiformis	4b
		4b'
Limopsis scalaris		G
	Myrtaea spinulosa	4b"
	L. pisiformis	4a
Corbula pisum		D
	Corbula pisum etc.	3c
Myrtaea spinulosa		3P + 2d
	Nuculana minima	3b"
	Ven. sulcata	3b'
Ven. sulcata Nuc. minima Lut. pisiformis }		3b
	Nuculana minima	3a+ 2d
C. pisum, N. minima, etc.		D
	C. pisum, N. minima, etc.	1+2P
	Lut. pisiformis Nuc. minima?	
Lut. pisiformis Nuc. minima?		

Gastropoda & Scaphopoda

Base of Highs	Tops of Highs	Zonation
		5b?
	Turritella spp. etc.	5a
	"Eopleurotoma" sp. 1	5G
		4c"
A. elegans "Eopleurotoma" sp. 1 (B) }	C. parva D. pellucens }	4c
		4c'
Turritella spp.		
Eopleurotoma sp. 1 (A)	D. formosa	
	M. bifidoplicata	4G
	Xenophora sp. 1.	G
M. bifidoplicata	Acrilla sp. 1.	4a
Triforis? sp. 1, D. formosa D. pellucens etc.		D
	Calcareous spp.	3c
Naticids spp.		
	Turritella spp. Acrilla sp. 1. }	3G
		3b
Turritella spp. Acrilla sp. 1. }		
		3a
	Turritella spp. M. bifidoplicata Turrid sp. 3. }	
Turritella spp. etc.		2d
		D
	Turritella spp. etc.	
	Alvania bartonensis	
Turritella spp.		2c
		2G
Drillia formosa D. pellucens S. bartonense M. bifidoplicata D. striatum Alvania bartonensis }	D. pellucens	
		2b
	Turritella spp.	
		2a
Turritella spp.		1G

Other Groups

Top S. gregoryi	→
Base Microplankton	→
Base Plant debris	→
Top Plant debris Microplankton Batop. glandiformis }	→
Base S. gregoryi	→
Top Bregmaceros minimus	→
Base B. minimus B. glandiformis }	→
Top Bregmaceros minimus	→
Top Vertebrate debris	→
Base Bregmaceros minimus	→
Base Vertebrate debris	→
Top Worm Tube Type 1	→
Base Worm Tube Type 1	→

Composite Zonation

5b	
5a"	
5a	
5	D
5a'	
	T. Eopleurotoma sp. 1 B. Microplankton, C. squammosa
4c'''	
4c	
	B "Eopleurotoma" sp. 1 (B)
4c"	
	T. Microplankton, Plant debris, L. scalaris, B. glandiformis, Elph. latidorsatum. B. Turritella spp.
4	
4b'	
	G
	T. Ast. brandhorstiana Cib. tenellus
4a	
	B. Triforis? sp. 1., D. formosa, B. glandiformis, A. brandhorstiana.
3c"	
3c	
	D
3c'	
3	
3b	
	B. Cib. tenellus, Esp. 4, Myrt. spinulosa
	T Cib. pygmeus, B. C. vialovi.
3a	
2d'''	
	T. Turritella spp. N. rectus
2d 2d	D
2d'	
	B. Turritella spp.
2c 2	
	B. A. bartonensis
2b	
	T. N. prestwichianus B. N. rectus
2a	
1	
	B. N. prestwichianus

D = Decalcified sequences. G = Sample gaps.

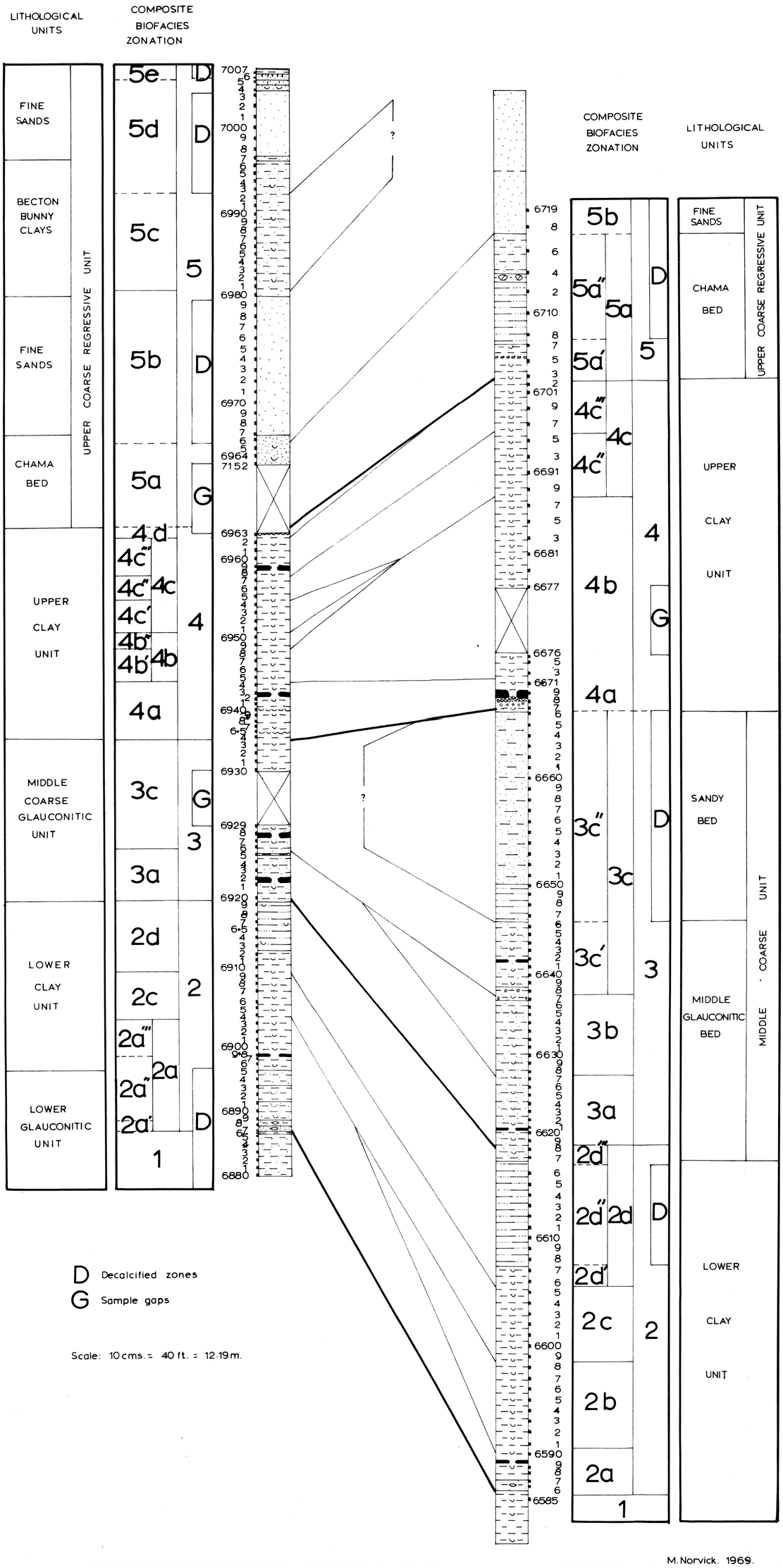
Scale : 10cms. = 40 ft. = 12.19m.

M. Norvick. 1969.

BIOFACIES CORRELATIONS IN THE BARTON BEDS

CHRISTCHURCH BAY

ALUM BAY



M. Norvick. 1969.