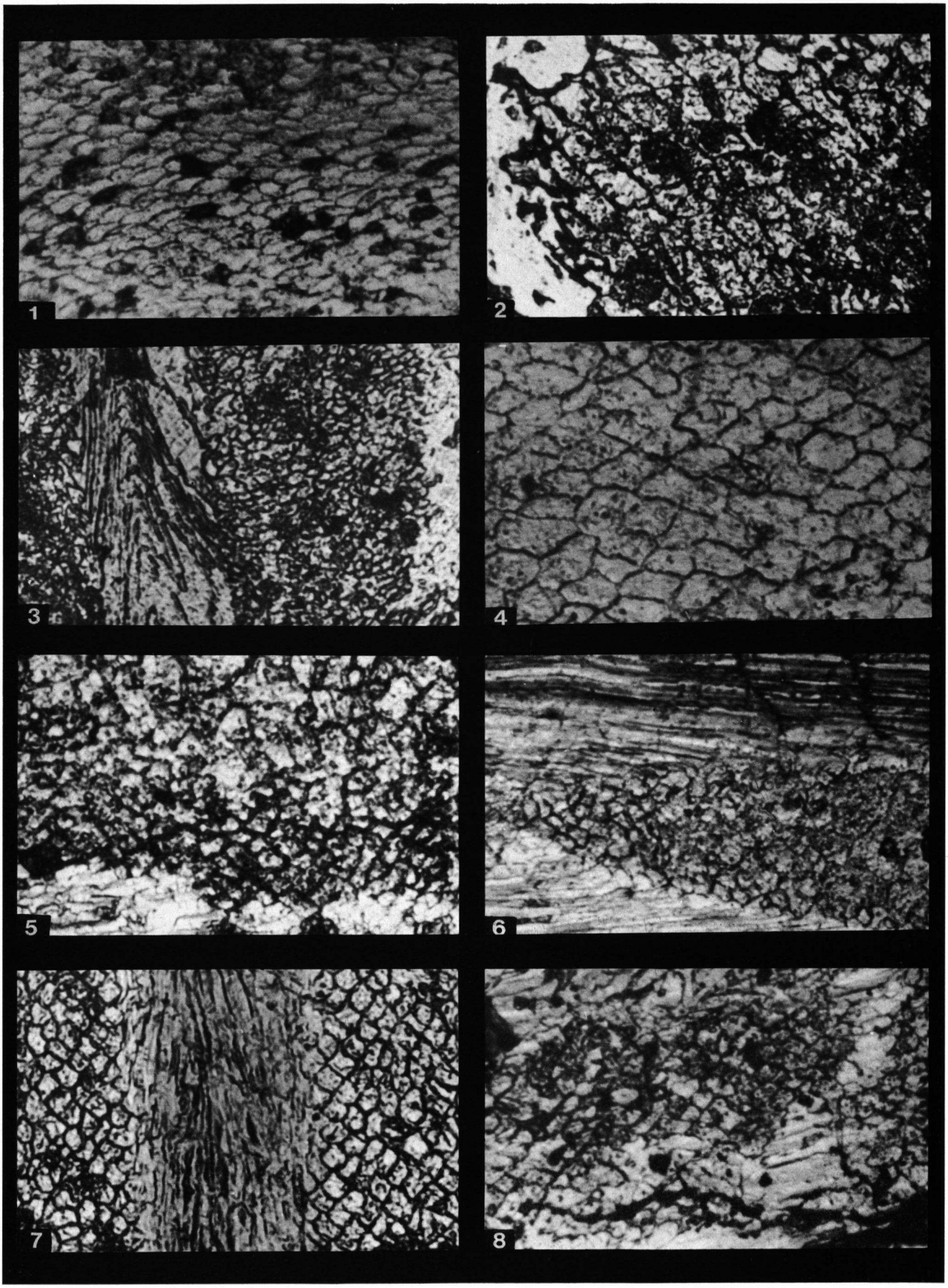
PLATES

PLATE I

Shell mosaics. 180 ×. Peels.

Fig. 1. Shell mosaic of *Sphaerirhynchia wilsoni.*
Fig. 2. Shell mosaic of *Hebetoechia hebe.*
Fig. 3. Shell mosaic of *Hebetoechia hebe.* In very posterior part of brachial valve. The extreme fineness of the elements may be due to local inframarginal cell division. Note septum with moderately diverging fibres.
Fig. 4. Shell mosaic of *Eoglossinotoechia mystica.*
Fig. 5. Shell mosaic of *Obturamentella lebanza.*
Fig. 6. Shell mosaic of *Eoglossinotoechia sylphidea.*
Fig. 7. Shell mosaic of *Glossinulus (Glossinotoechia) henrici.*
Fig. 8. Shell mosaic of *Glossinulus (Glossinotoechia) latus.*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8

PLATE II

Fig. 1—6: shell mosaics. 180 ×. Peels.

Fig. 1. Shell mosaic of *Eucharitina eucharis.*
Fig. 2. Shell mosaic of *Eucharitina eucharis.*
Fig. 3. Shell mosaic of *Kransia parallelepipeda.*
Fig. 4. Shell mosaic of *Uncinulus orbignyanus.*
Fig. 5. Shell mosaic of *Decoropugnax berenice.*
Fig. 6. Shell mosaic of *Hypothyridina cuboides.*
Fig. 7. Part of longitudinal section through ventral valve of *Uncinulus orbignyanus.* Anteriorly (= to the left) the shell is of a fibrous structure; posteriorly it is predominantly prismatic. The transition is gradual. The fibrous part of the shell has a clearly stratified appearance. The stratification can vaguely be traced in the prismatic layer. 12×.

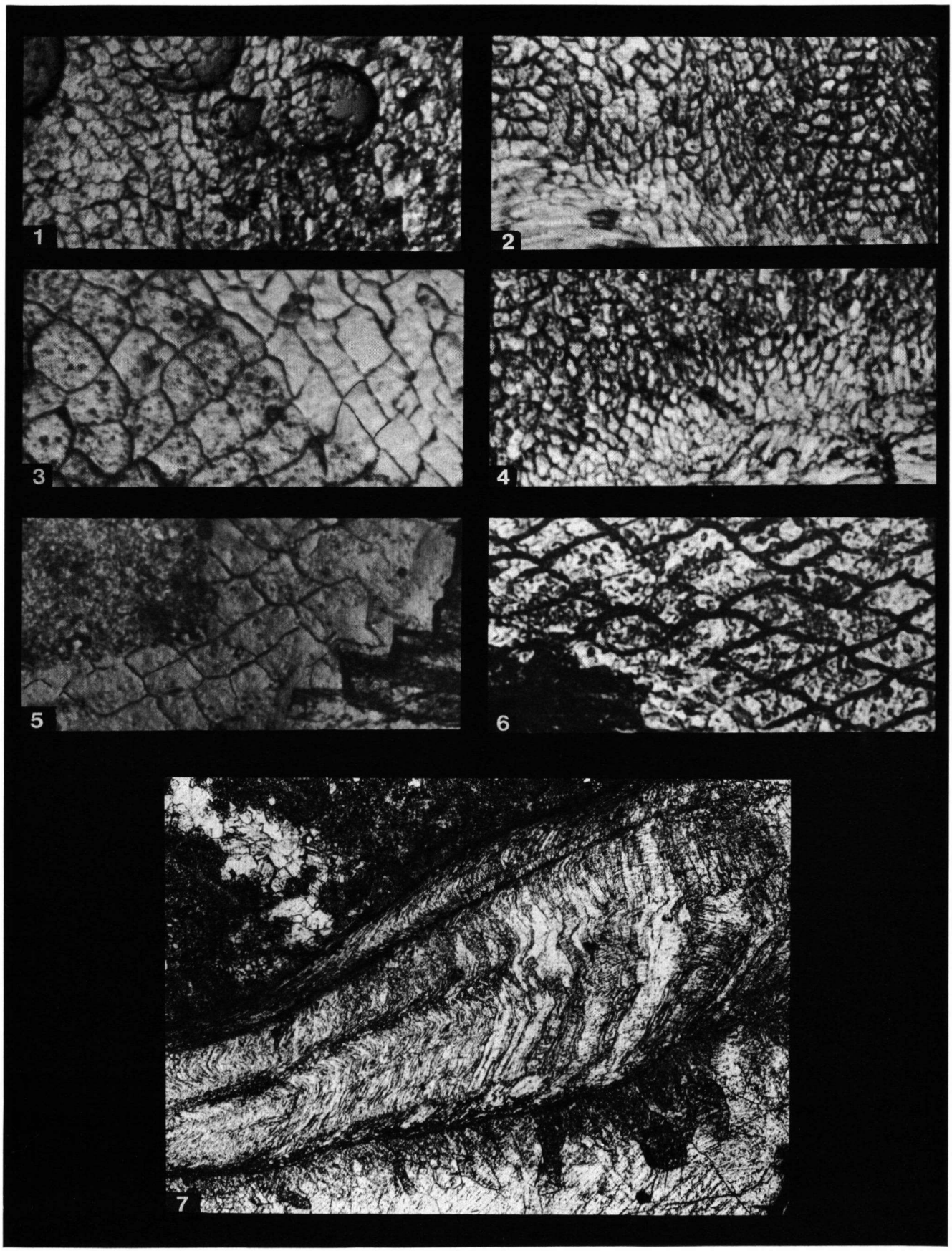
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PLATE III

Fig. 1. Transverse section through the shell of *Trigonirhynchia pareti,* showing primary layer (a) and fibres of secondary layer (b). The primary layer is thicker in the costa than in the grooves. Since the fibres of the secondary layer are not cut exactly transversely, but more or less at random direct inferences on the size of the fibres can hardly be made on this basis (see p. 18). It is however not unlikely that transverse sections through these fibres would show that the fibres are small near the primary layer (i.e. near the commissure at the moment of their formation) and enlarge towards the inner shell surface. In the lower right corner of the photograph the fibres even display a very irregular form. The fibres below the grooves appear to be smaller than those below the costa. This would be consistent with our explanation of the strong deviations of the fibres in this species (see p. 26; fig. 20, 27—29, and Plate V). Acetate peel. 100 ×.

Fig. 2. Tangential section through the umbonal part of the dorsal valve of *Kallirhynchia concinna.* The dorsal beak is situated outside the photograph near the left bottom corner. a = primary layer; b = septalial cavity; c = lateral apical cavity; d = hinge socket filled up with fibrous material. The fibres are cut in many different directions. Acetate peel. 100 ×.

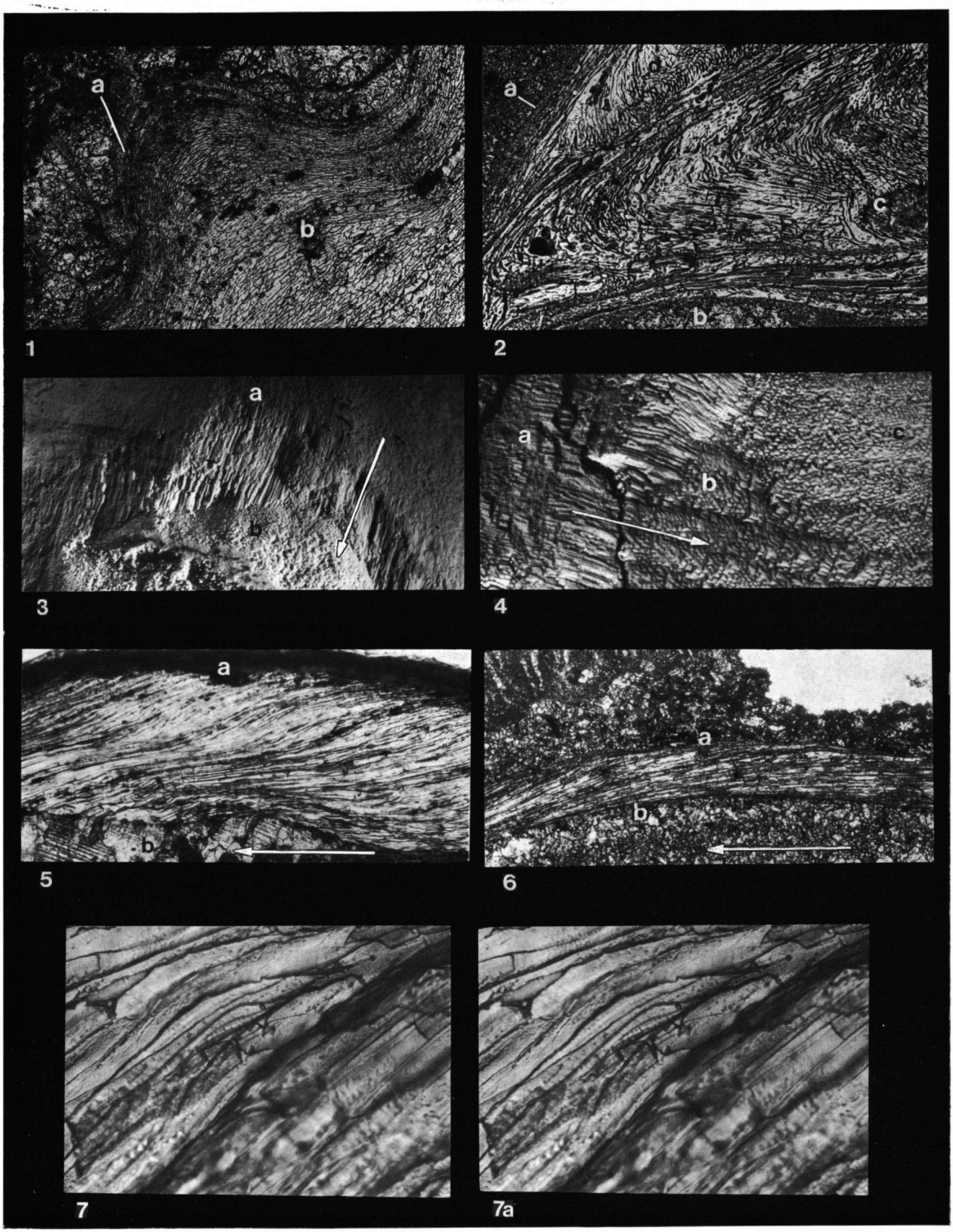
Fig. 3. *Kransia goldfussii.* Short, anteriorly directed thick fibres on unchipped surface. Close to paries geniculatus on concha plana. The arrow points to the anterior. a = outer shell surface; b = surface of internal mould. 10 ×.

Fig. 4. *Hypothyridina cuboides.* As fig. 3. The surface of the internal mould displays a shell mosaic at c. 12 ×.

Fig. 5. *Kransia parallelepipeda.* Longitudinal section through part of the ventral valve. Longitudinal sections through fibres. a = outer shell surface; b = inner shell surface. The arrow points to the anterior, as do the fibres. 40 ×.

Fig. 6. *Glossinulus (Glossinotoechia) latus.* As fig. 5. 40 ×.

Fig. 7 + 7a. *Trigonirhynchia pareti.* Stereoscopic photographs of a chip of fibres of the secondary shell layer. The fibres are rather irregularly arranged. 400 ×.


a
b
1
a
c
c
b
2
a
b
3
a
c
b
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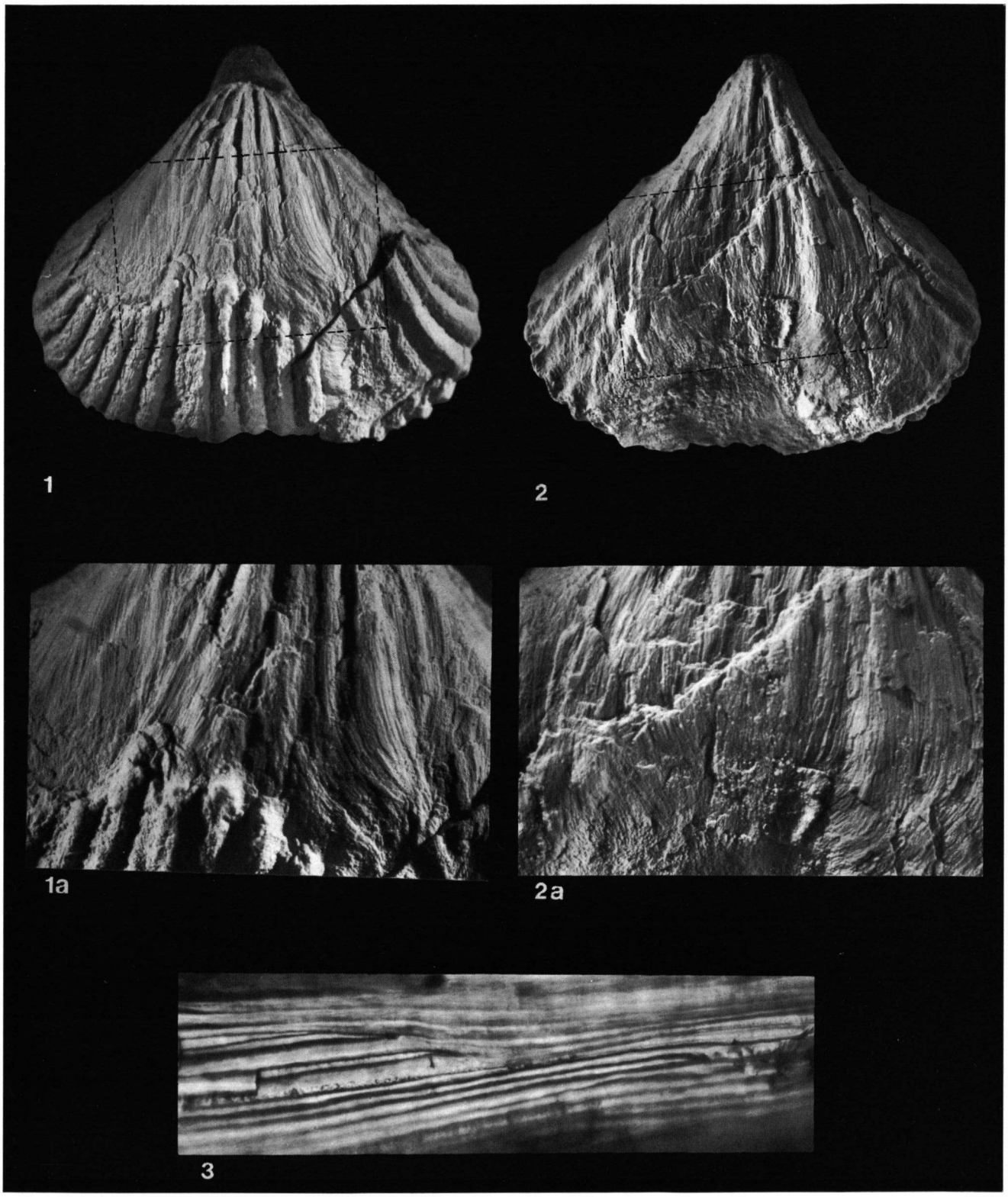
a
b
5
a
b
6
7
7a

PLATE IV

Fig. 1. *Sirorhyncha trinacria tenuirostris.* Dorsal view. 6 ×.
Fig. 1a. Detail. 10 ×.
The fibres are deviated towards the sectors of maximal growth rate of the shell surface.
Fig. 2. Same specimen as fig. 1. Ventral view. 6 ×.
Fig. 2a. Detail. 10 ×.
Fig. 3. *Kallirhynchia concinna.* A bundle of fibres of the tooth showing divergence as described in Ch. II, section 8. 600 ×.


1
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1a
2a
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PLATE V

The course of the fibres in the costae of *Trigonirhynchia pareti.*

Fig. 1. Lateral view of steep costa bordering the median dorsal fold. The sharp deviation in the direction of the fibres is clearly visible. a = outer shell surface; b = surface of internal mould. 15 ×.

Fig. 2. Low costa and grooves in the sinus. Same specimen as in fig. 1. Note fan-wise spreading of fibres. a = outer shell surface; b = surface of internal mould; the arrow points to the anterior. 10 ×.

Fig. 2a. Detail of fig. 2. 25 ×.

Fig. 3. As fig. 2, but other specimen. 10 ×.

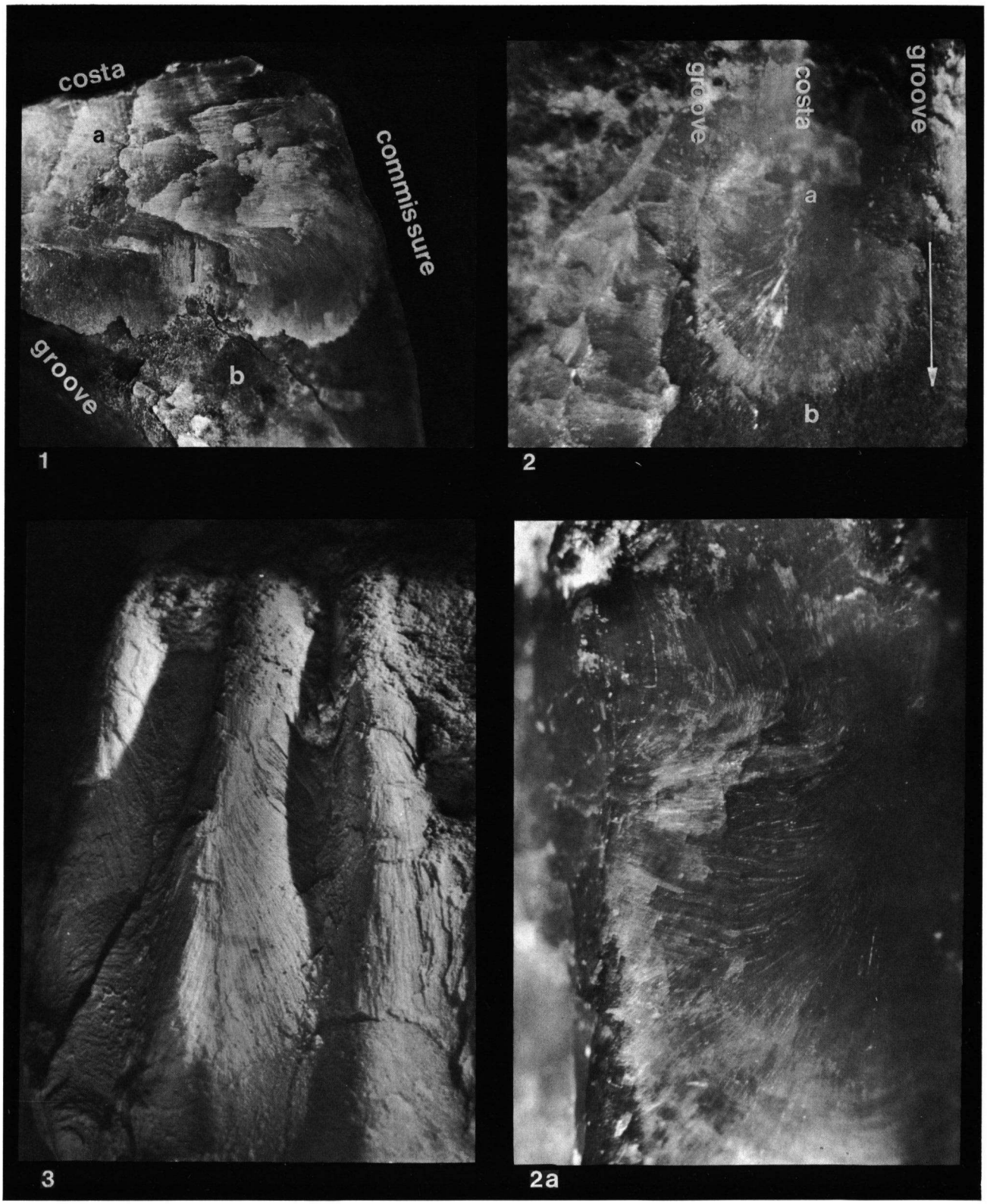

costa
a
commissure
groove
b
1
groove
costa
groove
a
b
2
3
2a

PLATE VI

Fig. 1a. *Trigonirhynchia pareti.* Peel of internal mould at the extremity of a groove. 10 ×.
Fig. 1b. Detail of fig. 1a. 25 ×.
Fig. 1c and 1d. Details of fig. 1b. In both photographs the magnification is the same (250 ×). Evidently the ends of the fibres are finer in 1d than in 1c. The finer ends of the fibres are concentrated in a median zone of the groove. This zone slightly broadens posteriorly.
Fig. 2 and 3. The course of the fibres in the costae of *Corvinopugnax corvinus.* Hardly any deviation occurs. Very locally the shell mosaic is displayed. The elements are very large. Fig. 2 : 25 ×; fig. 3 : 12 ×.

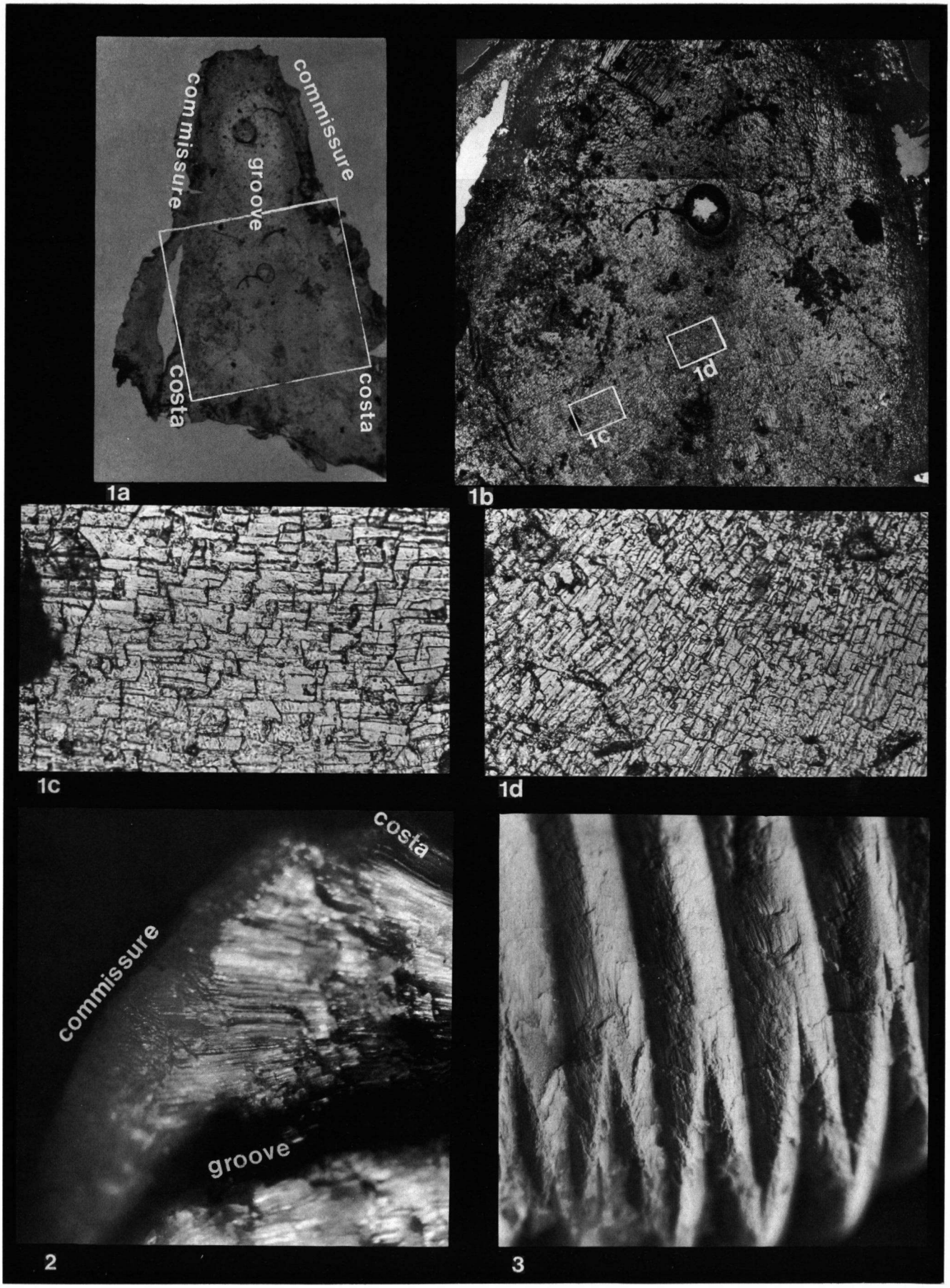

commissure
commissure
groove
costa
costa
1a
1d
1c
1b
1c
1d
costa
commissure
groove
2
3

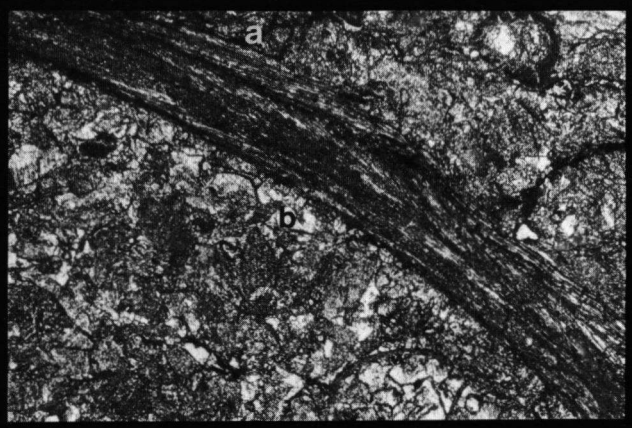
PLATE VII

Fig. 1a, b, and c. *Uncinulus orbignyanus.* Stratified shell. Longitudinal section through ventral valve. The photos are taken at some distance from one another. 1a is part of the paries geniculatus. Here, the layers become inconspicuous. a = outer shell surface; b = inner shell surface. 35 ×. Peel.

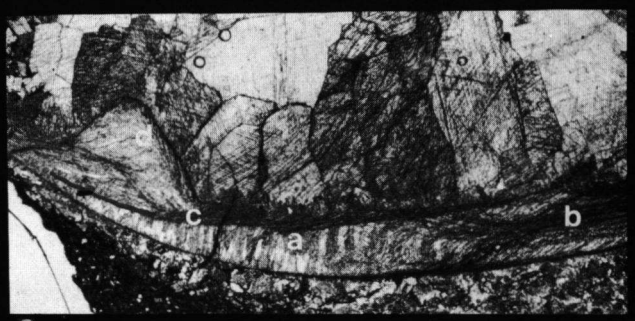
Fig. 2. *Uncinulus orbignyanus.* Longitudinal section through posterior part of the ventral valve. a = prismatic layer; b = stratified fibrous shell; c = myotest of ventral diductor; d = padlike outgrowth of shell posterior to ventral diductor. 10 ×. Peel.

Fig. 3. *Uncinulus orbignyanus.* Longitudinal section. Ventral valve. The layers intersect the dark coloured myotest. a = outer shell surface; b = inner shell surface; the arrow points to the anterior. 35 ×. Peel.

Fig. 4. *Uncinulus subwilsoni.* Small part of longitudinal section through the ventral valve. The structure is rather chaotic. b = inner shell surface. 100 ×. Peel.



1a



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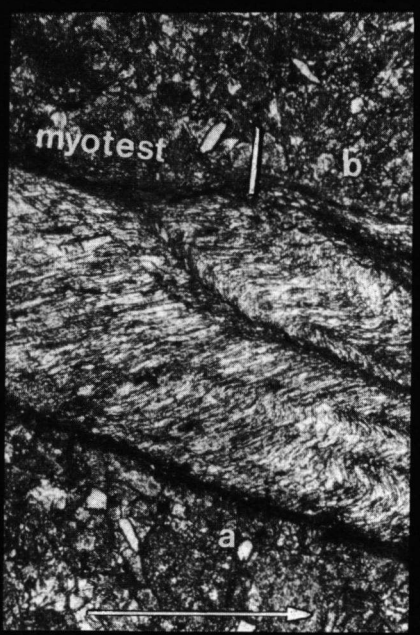

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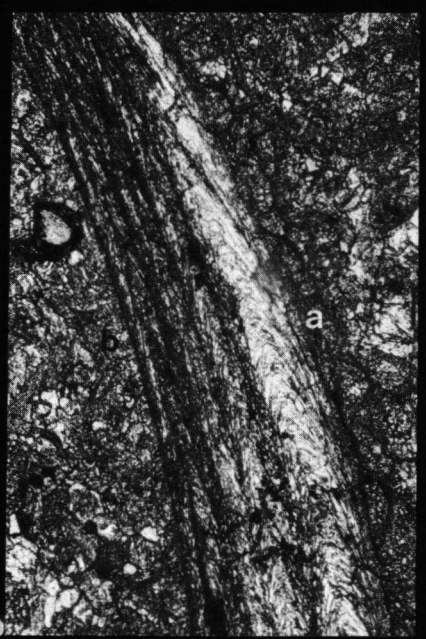
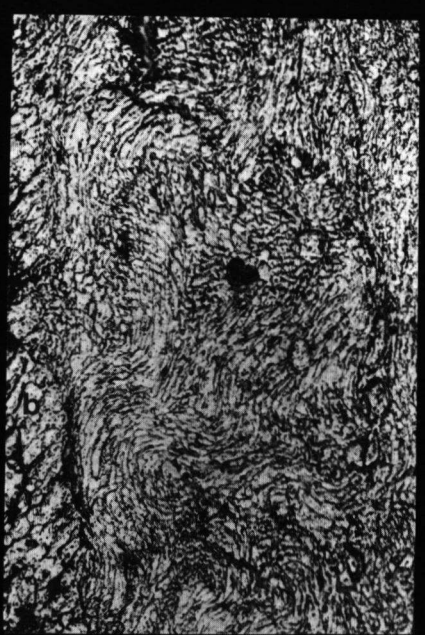


1b



4

1c

PLATE VIII

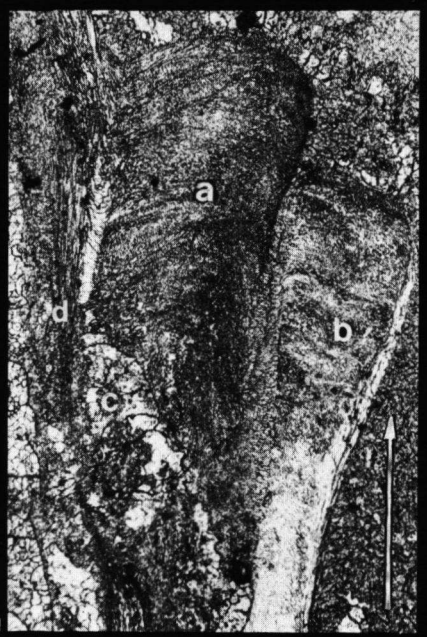
Trigonirhynchia pareti. Cardinal tooth and dental plate in sections parallel to the normal plane. Cf. fig. 35 and 36. Peels.

Fig. 1a. Tooth near its base. The fibres are transversely cut. a = tooth; b = inner socket ridge; c = denticular cavity; d = denticulum; the arrow points to the anterior. The growth lines are very vague; they are evidently cut off at the posterior surface of the tooth. 45 ×.

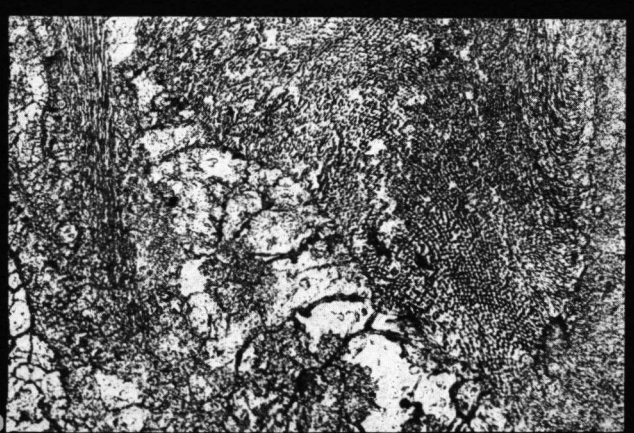
Fig. 1b. Detail showing the denticular cavity, the denticulum and the posterior part of the tooth. Resorption most probably took place along the boundary between the denticular cavity and the tooth. 80 ×.

Fig. 2. Section through the dental plate. a = lateral apical cavity; b = central apical cavity; the arrow points to the anterior. 100 ×.

Fig. 3. Tooth and socket, showing the deep crenulations by which they grip each other like cog-wheels. a = tooth; b = inner socket ridge; the arrow points to the anterior. 80 ×.



1a



1b

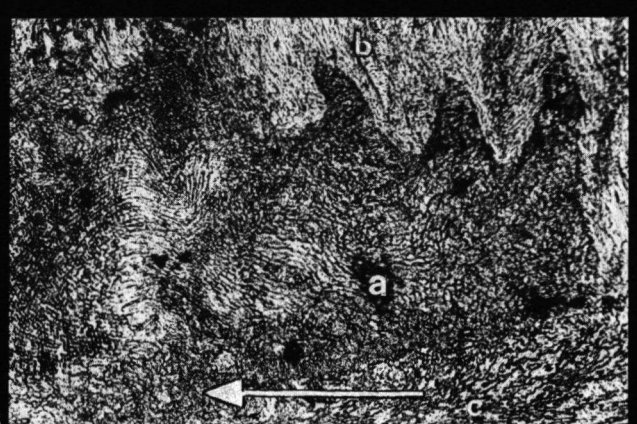


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PLATE IX

Fig. 1. *Kransia parallelepipeda.* Ahrdorfer Schichten (Eifel). Section parallel to the normal plane through the dorsal septum. Central mediotest flanked by very short, strongly diverging fibres. The septum is only some 40 μ in thickness. 250 ×. Peel.

Fig. 2. *Kransia parallelepipeda.* Rommelsheimer Schichten (Eifel). Section parallel to the normal plane through the dorsal septum. Central mediotest flanked by diverging fibres. The difference in thickness of the septa figured in fig. 1 and fig. 2 may be due to differences in ontogenetical development. 100 ×. Peel.

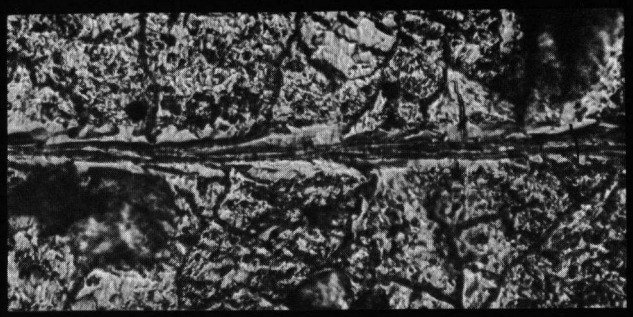
Fig. 3a. *Sphaerirhynchia wilsoni.* Silurian, Gotland. Section parallel to the normal plane through the dorsal septum. No mediotest. The fibres are parallel to the plane of symmetry. The median fibres are thicker than the lateral ones. 100 ×. Peel.

Fig. 3b. Detail of fig. 3a. 250 ×.

Fig. 4. *Eoglossinotoechia mystica.* Lochkov, Bohemia. Section parallel to the normal plane through the dorsal septum. No mediotest. Fibres slightly diverging. Transition between septa of *Kransia* and of *Sphaerirhynchia wilsoni.* 200 ×. Peel.

Fig. 5. *Kallirhynchia concinna.* Bathonian, Calvados, France. Transverse section through the articulatory device. The very posterior tip of the tooth is cut. Tooth and rest of ventral valve are disconnected in this section. Some fibres can be followed from one surface of the tooth to the other. Along at least one of these surfaces resorption must have taken place. Evidently the gap between the tooth and the ventral valve must be explained in this way. 20 ×. a = base of dental plate, ventral valve; b = tooth; c = inner socket ridge; d = outer socket ridge. Peel.

Fig. 6a and b. *Kransia parallelepipeda.* Stereoscopic photographs of serial sections drawn on glass plates. The three-dimensional reconstruction given in fig. 55 has been drawn from these photographs.



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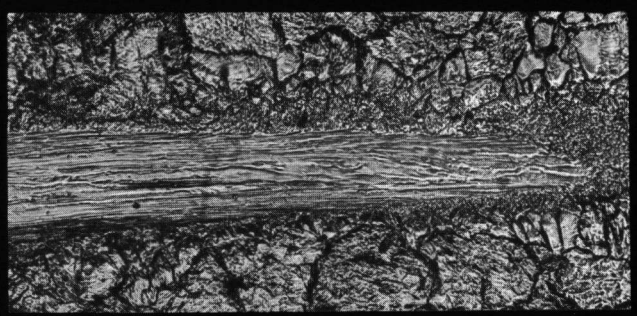
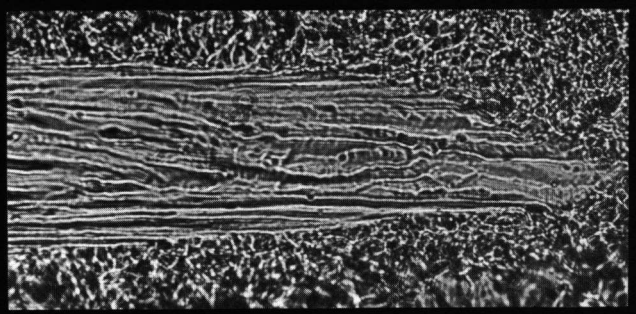
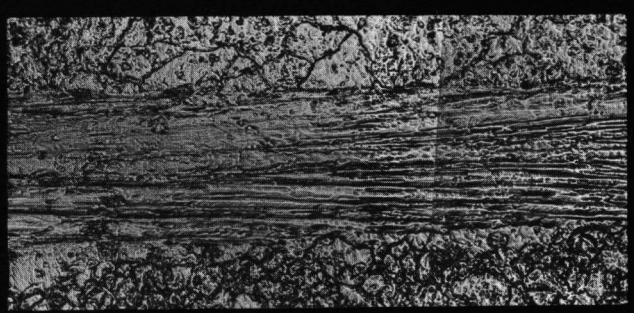


3a



3b



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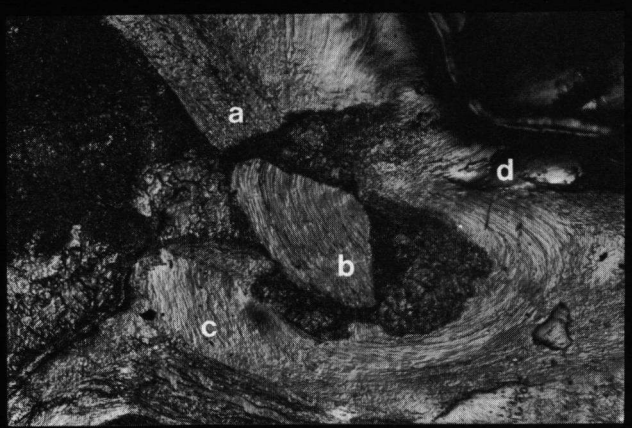

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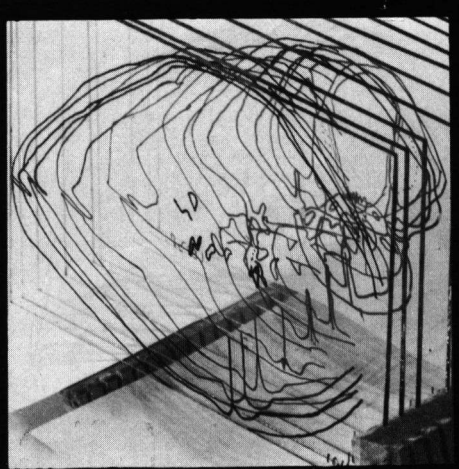
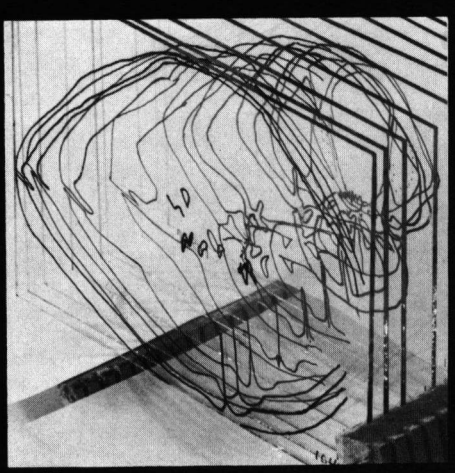


6a



6b

PLATE X

Fig. 1a. *Sphaerirhynchia wilsoni.* Upper Wenlock, Visby, Gotland. Geol. Mus. Delft, no. 1655. Posterolateral view of shell, showing strophic hinge, moderately grading zigzag deflection of commissure, suppression-point, paries geniculatus and primary and secondary grooves. 5 ×.
Fig. 1b. Same specimen; part of frontal paries geniculatus with pronounced zigzag deflection, costae with primary and secondary grooves and lateral boundary of sulcus and fold. 10 ×.
Fig. 1c. Same specimen; posterior view showing strophic hinge; cf. text-fig. 73. 10 ×.
Fig. 1d. Idem, posterolateral view. 10 ×.
Fig. 2. *Kransia primipilaris.* Middle Devonian, Gerolstein, Eifel. Geol. Mus. Leiden, no. St. 139981. Anterolateral view. Note costation-pattern and straight and depressed commissure. 5 ×.
Fig. 3. *Kransia parallelepipeda.* Middle Devonian, Gerolstein. Geol. Mus., Leiden, no. St. 139982. Anterior view. Apart from median fold the commissure is straight. 8 ×.

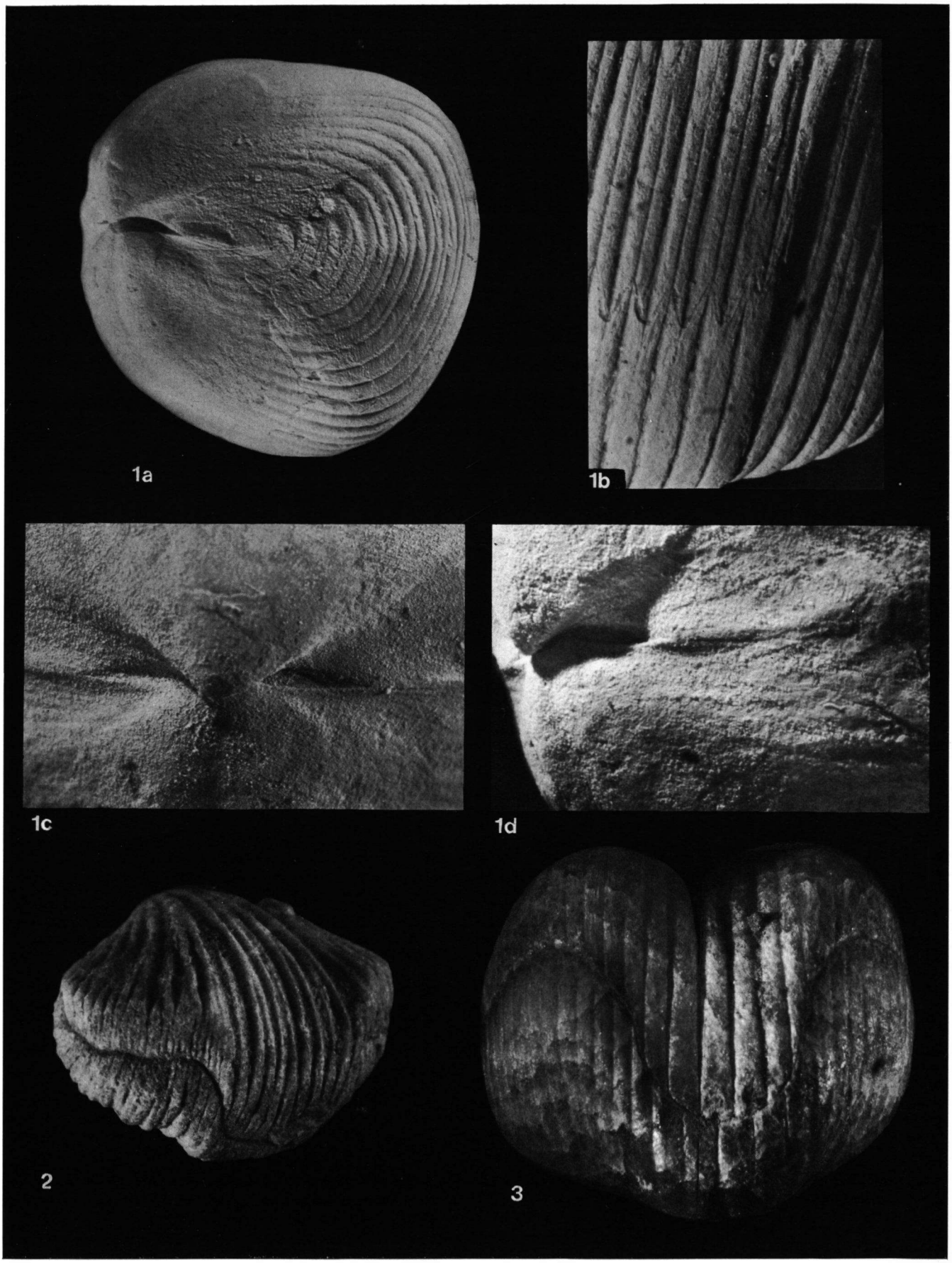

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PLATE XI

Fig. 1a. *Eoglossinotoechia mystica.* Lochkov, Karlštejn, Bohemia. Figured by Barrande (1879, pl. 120, fig. X1) and by Havlíček (1961, pl. XIX, fig. 3 and 4). Národní Muzeum, Prague, SBNM-BR 197/60. Lateral view. Grading in zigzag deflection. Pointer indicates hinge point. 4 ×.
Fig. 1b. Same specimen, detail. No squama. Suppression-point, hinge point and small part of ventral cardinal area. 7 ×.
Fig. 2. *Eoglossinotoechia cacuminata.* Lochkov. Národní Muzeum, Prague. Anterior view, part of commissure. Sharp zigzag deflections. Costae, primary and secondary grooves. 15 ×.
Fig. 3. *Glossinulus (Glossinotoechia) latus.* La Vid Formation, Cantabrian Mountains, Spain. Geol. Mus. Leiden, no. St. 139983. Anterior view, part of commissure. Zigzag deflections reduced. Costae, primary and secondary grooves. 10 ×.
Fig. 4a. *Eoglossinotoechia sylphidea.* Koněprusy Limestone, Koněprusy. Národní Muzeum, Prague. Posterolateral view. Pointer indicates hinge point. Reduced zigzag deflection. 4 ×.
Fig. 4b. Same specimen, detail. Reduced squama. Posterior costae die out against squama. Growth lines in brachial valve indicate that curve in posterior part of commissure is not a non-strophic deflection. 8 ×.
Fig. 5. *Eoglossinotoechia sylphidea.* Koněprusy Limestone, Koněprusy. Geol. Mus. Leiden, no. St. 139984. Ventral view of concha plana. Composite zigzag deflection. 10 ×.
Fig. 6. *Eucharitina eucharis.* Koněprusy Limestone. Národní Muzeum, Prague. Concha plana, just before geniculation. Anterior view, showing zigzag deflection of large amplitudes. In dorsal and in ventral view the pattern is the same as in fig. 5. 5 ×.
Fig. 7. *Glossinulus (Glossinotoechia) henrici.* Koněprusy Limestone, Koněprusy, Bohemia. Geol. Mus. Leiden, no. St. 139985. Ridge on ventral concha plana is trace of inverse geniculation. Paries geniculatus with costae and primary and secondary grooves. Growth lines on paries geniculatus show reduction in amplitude of zigzag deflections. 5 ×.
Fig. 8. *Glossinulus (Glossinotoechia) henrici.* Koněprusy Limestone, Koněprusy, Bohemia. ÚÚG, Prague, no. VH 561. Umbonal part of shell, dorsal view. Ventral cardinal areas, flanking large deltidium in suberect, strongly protruding ventral umbo.
Fig. 9. *Glossinulus (Glossinotoechia) henrici.* Koněprusy Limestone, Koněprusy, Bohemia. ÚÚG, Prague, no. VH 562. Concha plana in stage of inverse geniculation. Lateral view.
Fig. 10. *Glossinulus (Glossinotoechia) henrici.* Koněprusy Limestone, Koněprusy, Bohemia. ÚÚG, Prague, no. VH 563. Lateral view of concha alta, just after geniculation. Note zigzag deflection with considerable amplitudes.
Fig. 11. Hebetoechia nitidula. Koněprusy Limestone, Koněprusy, Bohemia. Geol. Mus. Leiden, no. St. 139986. Dorsal view. Note inter alia deltidium and suberect rather short ventral umbo. 10 ×.
Fig. 12. *Hebetoechia nitidula.* Koněprusy Limestone, Koněprusy, Bohemia. ÚÚG, Prague. Anterior view. Note paries geniculatus, primary and secondary grooves and commissure. 13 ×.

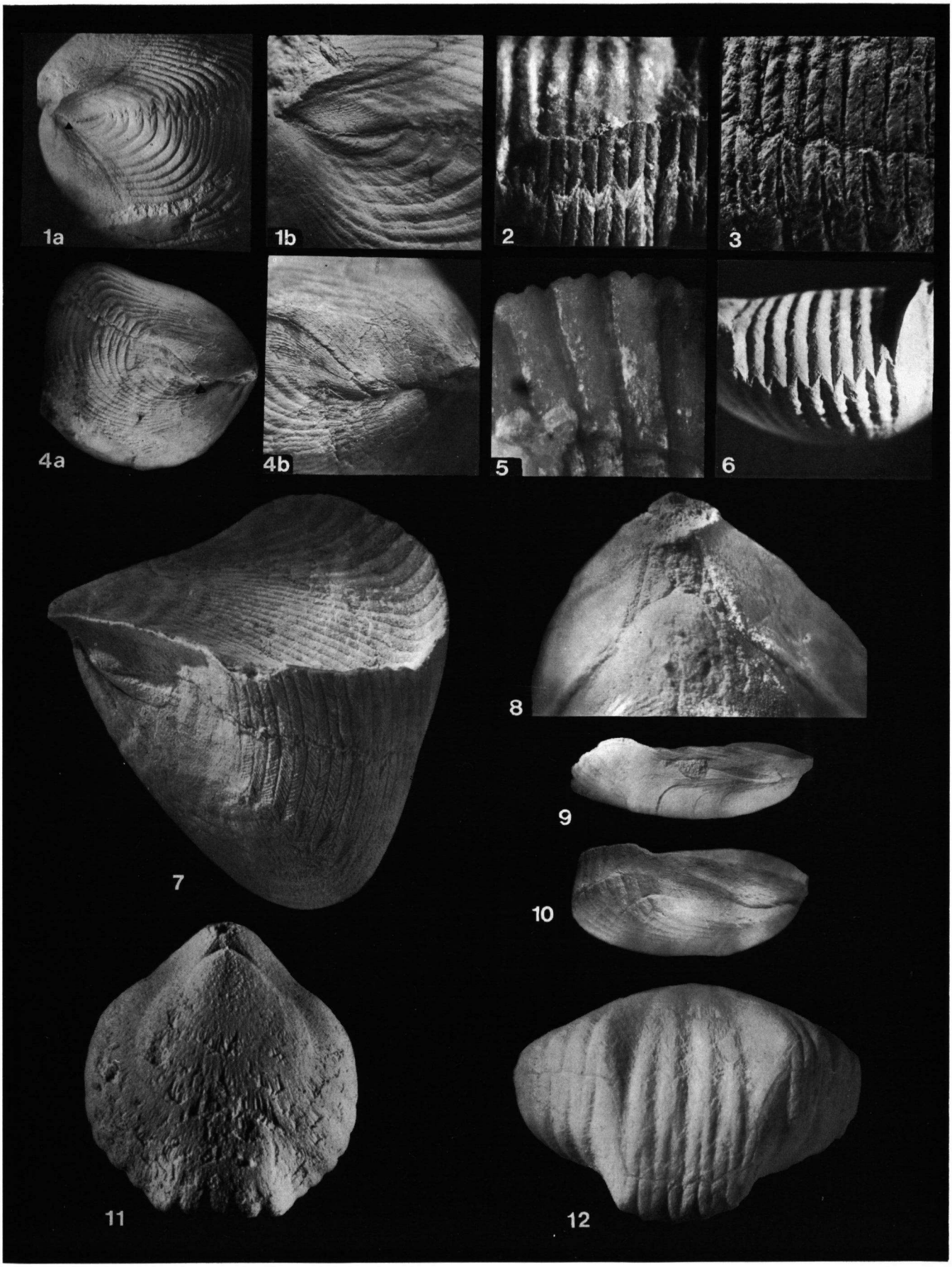
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PLATE XII

Fig. 1. *Uncinulus maledictus maledictus.* Zlíchov Formation, Hlubočepy, u kapličky. ÚÚG, VH 566. Isolated ventral valve; posterolateral view, showing posterior part of ventral commissure with bases of marginal spines, glotta, tooth and ventral umbo. 16 ×.

Fig. 2. *Uncinulus maledictus maledictus.* Zlíchov Formation, Hlubočepy, u kapličky. ÚÚG, VH 568. Anterolateral view in shell of which the tongue is removed. Marginal spines are visible. 7,5 ×.

Fig. 3. Same specimen. Anterolateral commissure; shell slightly opened, bases of marginal spines visible. 20 ×.

Fig. 4. *Uncinulus maledictus maledictus.* Zlíchov Formation, Hlubočepy, u kapličky. ÚÚG, VH 564. Anterior view of slightly opened shell with bases of marginal spines. 15 ×.

Fig. 5. *Markitoechia marki.* Zlíchov Formation, Hlubočepy, u kapličky. ÚÚG. Lateral view. Pronounced, poorly graded zigzag deflection and squama. Erect ventral umbo with deltidium. 10 ×.

Fig. 6. *Markitoechia marki.* Zlíchov Formation, Hlubočepy, u kapličky. ÚÚG. Anterolateral view. Costae, primary and secondary grooves and zigzag-deflected commissure. 10 ×.

Fig. 7. *Markitoechia marki.* Zlíchov Formation, Hlubočepy, u kapličky. ÚÚG, VH 559a. Pedicle valve, interior of anterolateral part of paries geniculatus, showing grooves in which the marginal spines of the brachial valve fit properly. Spines of pedicle valve are broken at their base. Only small part of valve edge is undamaged. 15 ×.

Fig. 8. *Obturamentella lebanza.* Lebanza Formation, N. Spain. Holotype. Geol. Inst. Leiden, coll. Binnekamp, specimen 116. Lateral view, showing squama and commissure.

Fig. 9. *Uncinulus orbignyanus.* Santa Lucía Formation, N. Spain. Geol. Mus. Leiden, no. St. 139987. Detail of lateral commissure; shell slightly opened; marginal spines. 20 ×.

Fig. 10. *Uncinulus orbignyanus.* Santa Lucía Formation, N. Spain. Geol. Mus., Leiden, no. St. 139988. Posterolateral view. Part of commissure, squama, umbo. Pointer indicates hinge point. 7,5 ×.

Fig. 11. *Uncinulus orbignyanus.* Santa Lucía Formation, N. Spain. Geol. Mus. Leiden, no. St. 139989. Posterolateral view. Costation, depressed commissure, squama. Ventral umbo is damaged. 5 ×.

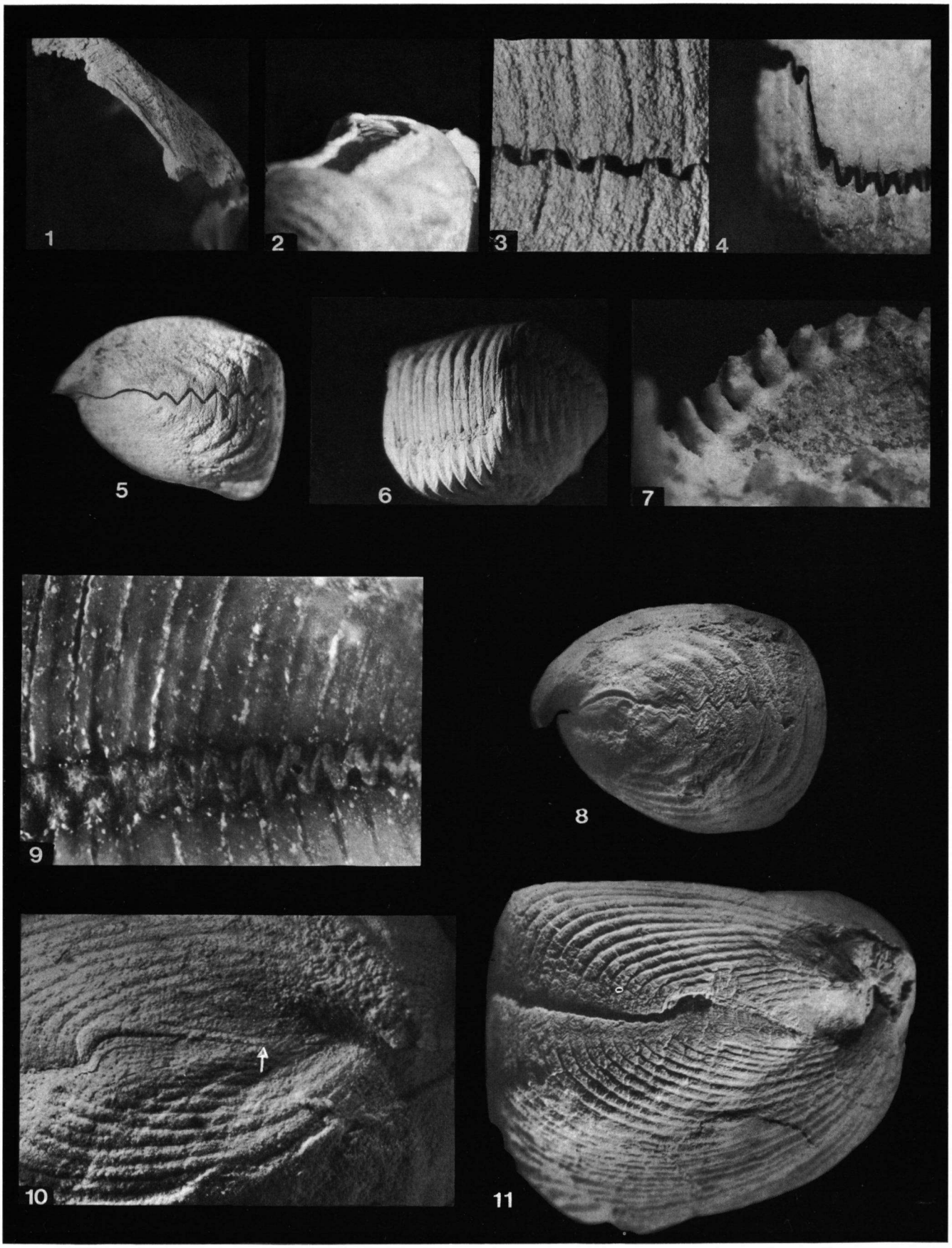
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PLATE XIII

Sections through marginal spines. Peels.

Fig. 1. Section transversely cutting through base of marginal spine of *H. cuboides*. a = paries geniculatus of opposite valve; arrow indicates primary shell layer. 30 ×.
Fig. 2. Longitudinal section through marginal spine of *H. cuboides*. The arrows indicate primary shell layer which is cut locally. 40 ×.
Fig. 3a. Detail of 3b. Part of partition with protuberance and primary shell layer (arrow!).
Fig. 3b. Section transversely cutting through marginal spines and partitions of *H. cuboides*. 15 ×.
Fig. 4. Section transversely cutting through marginal spine and paries geniculatus of *Glossinulus (Glossinotoechia) latus*. Arrows indicate primary layer. Broad basis of spine is just displayed.
Fig. 5. As fig. 4, but marginal spine is cut at its tip.
Fig. 6. *Glossinulus (Glossinotoechia) latus*. Longitudinal section through marginal spine. Arrows indicate primary layer.


a
a
1
4
2
6
5
3a
3b

PLATE XIV

Fig. 1. *Hypothyridina cuboides.* Upper Devonian, Grund, near Vienna. Geol. Mus. Leiden, no. St. 36691. Anterolateral view. Commissure is situated along margin of paries geniculatus. 2,5 ×.

Fig. 2. *Plethorhyncha sp.* cf. *altera.* Bohemia. ÚÚG, VH 556-a. Lateral view. Non-strophic shell. Large ventral palintrope. Nicklines cut off posterior costae. 5 ×.

Fig. 3a. *Kransia goldfussii.* Transverse section through shell. Note dorsal septum and slanting squama and glotta. Peel.

Fig. 3b. Detail of fig. 3a. Squama and glotta. Peel.

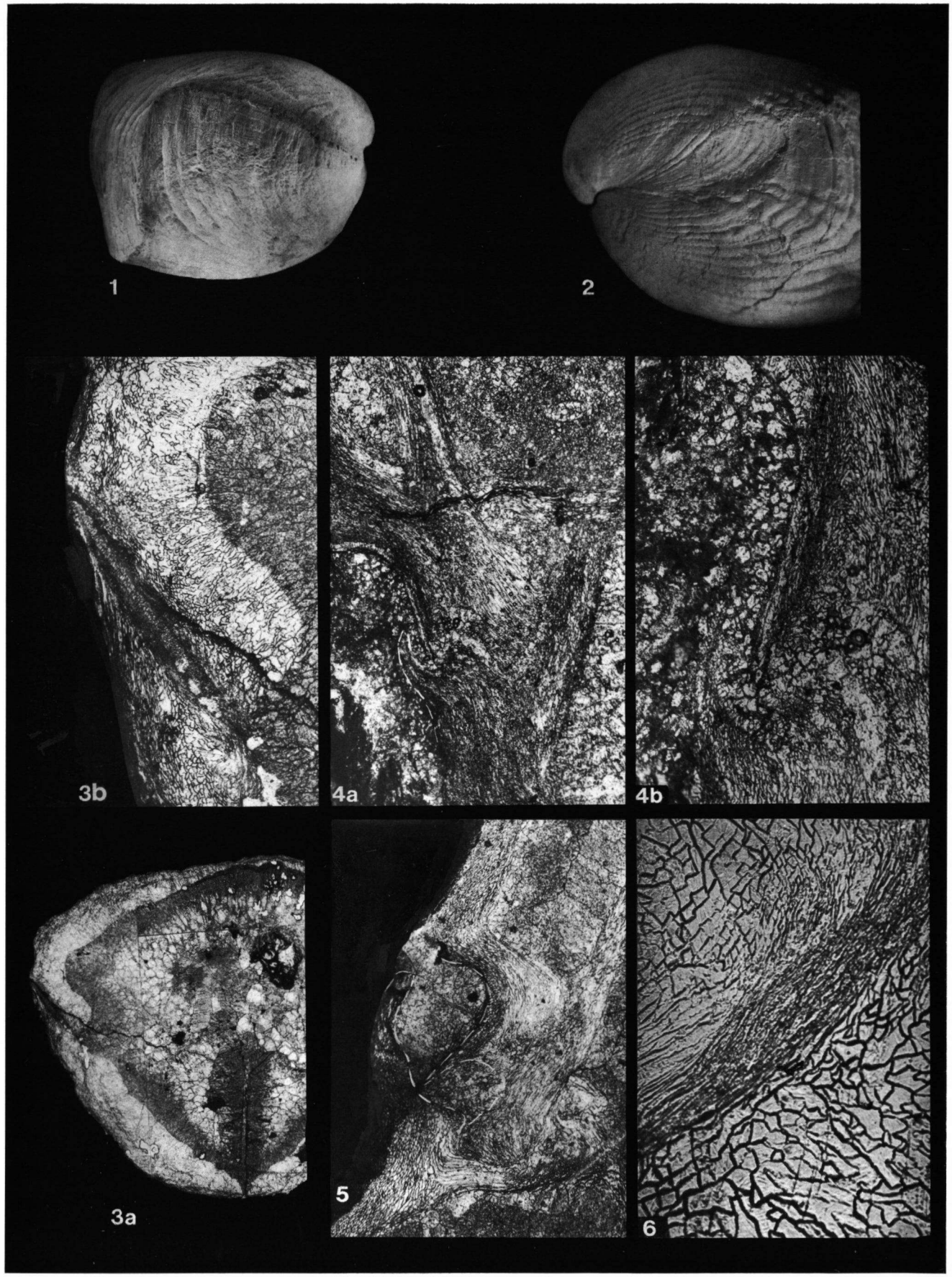
Fig. 4a. *Ptychomaletoechia* cf. *gonthieri.* Crémenes Limestone, N. Spain. Dorsal and ventral palintropes, covered with primary shell layer. Tooth, dental plate, socket, hinge plate. Transverse section. 30 ×. Peel.

Fig. 4b. Detail of fig. 4a. 60 ×.

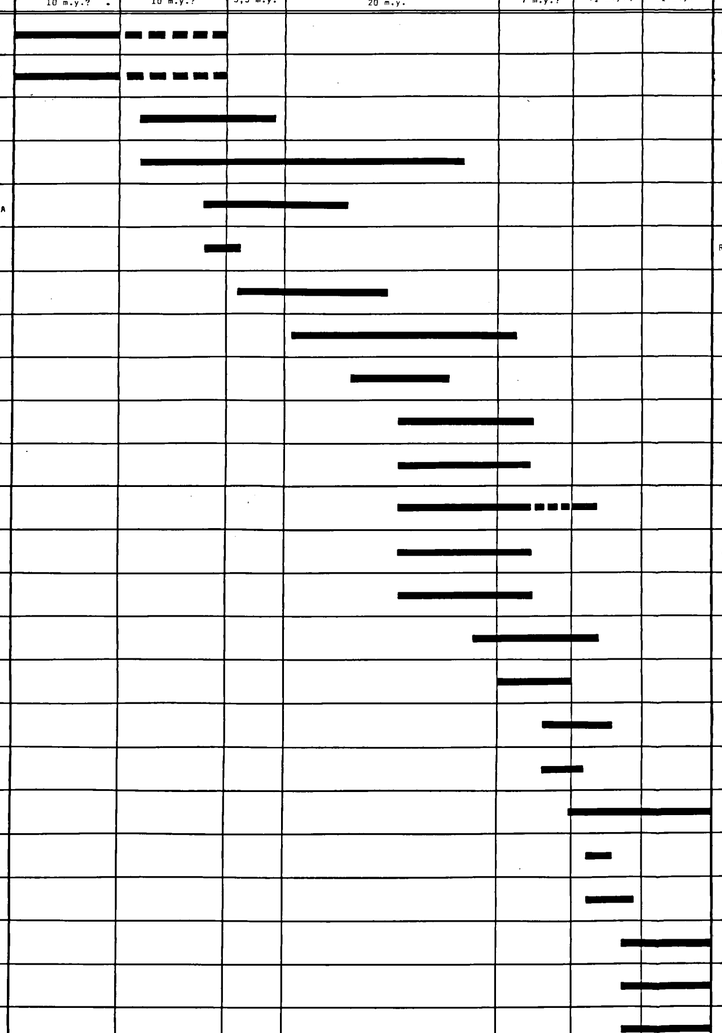
and 4b. 30 ×. Peel.

Fig. 5. *"Stegerhynchus" pseudolivonicus.* Koněprusy Limestone, Koněprusy, Bohemia. As fig. 4a and 4b. 30 ×. Peel.

Fig. 6. *Kransia primipilaris.* Part of transverse section through shell. Fibrous secondary shell material and myotest with chaotic structure. 50 ×. Peel.


1
2
3b
4a
4b
3a
5
6

Enclosure I



		MOSAIC ELEMENTS	VENTRAL UMBO CURVATURE AND SIZE	DELTIDIUM	COSTATION	SHELL SIZE	CONNECTIVUM	THICKNESS OF TEST POSTERIORLY	CARDINAL PROCESS	LATERAL EXPANSIONS CARDINAL PROCESS	DORSAL SEPTUM STRUCTURE	LENGTH OF HINGE LINE	SEPTALIUM	TYPE MARGINAL SPINES	STROPHIC - NON-STROPHIC	DOUBLE GENICULATION	MARGINAL SPINES FIT INTO GROOVES	STRATIFIED AND CHAOTIC SHELL STRUCTURE
1	ESTONIRHYNCHIA ESTONICA	FINE - MEDIUM SIZE	STRONGLY CURVED SHORT	INCIPIENT	FINE, STARTING HALFWAY, HARDLY SPLITTING	MODERATE	ABSENT	THIN	ABSENT	ABSENT	FIBRES PARALLEL	SHORT	MODERATE SIZE	—	STROPHIC	—	—	—
2	SPHAERIRHYNCHIA WILSONI	FINE - MEDIUM SIZE	STRONGLY CURVED SHORT	INCIPIENT	FINE, STARTING AT BEAKS HARDLY SPLITTING	MODERATE	ABSENT	THIN	ABSENT	ABSENT	FIBRES PARALLEL	SHORT	MODERATE SIZE	A	STROPHIC	—	—	—
3	HEBETOECHIA HEBE	GENERALLY VERY COARSE	NEARLY STRAIGHT RATHER SHORT	WELL DEVELOPED	MODERATE COARSENESS STARTING NEAR BEAKS NO SPLITTING	SMALL	ABSENT	THIN	INCIPIENT BILOBATE	ABSENT	FIBRES MODERATELY DIVERGING	VERY SHORT	MODERATE SIZE	A	STROPHIC	—	—	—
4	EOGLOSSINOTOECHIA CACUMINATA	RATHER COARSE	NEARLY STRAIGHT STRONGLY PROTRUDING	LARGE	FINE, STARTING AT BEAKS MODERATELY SPLITTING	SMALL	PRESENT	THIN	MODERATELY DEVELOPED	INCIPIENT	FIBRES SLIGHTLY DIVERGING	EXTREMELY SHORT	SMALL	A-B	STROPHIC	—	—	—
5	EOGLOSSINOTOECHIA MYSTICA	VERY COARSE	NEARLY STRAIGHT STRONGLY PROTRUDING	LARGE	FINE, STARTING AT BEAKS MODERATELY SPLITTING	MODERATE	PRESENT	THIN	INCIPIENT	INCIPIENT	FIBRES SLIGHTLY DIVERGING	EXTREMELY SHORT	MODERATE SIZE	A	STROPHIC	—	—	—
6	LANCEOMYONIA TARDA	RATHER COARSE	MODERATELY CURVED SHORT	SMALL	COARSE, STARTING HALFWAY NO SPLITTING	LARGE	ABSENT	THIN	ABSENT	ABSENT	FIBRES SUBPARALLEL	VERY SHORT	MODERATE SIZE	A	STROPHIC	—	—	—
7	PLETHORHYNCHA ALTERA	MEDIUM SIZE	MODERATELY CURVED SHORT	SMALL	COARSE, STARTING HALFWAY NO SPLITTING	LARGE	ABSENT	THICK	INCIPIENT	INCIPIENT	FIBRES SUBPARALLEL		SMALL	A	NON-STROPHIC	—	—	—
8	UNCINULUS SUBWILSONI	FINE	STRONGLY CURVED SHORT	INCIPIENT	VERY FINE, STARTING AT BEAKS STRONGLY SPLITTING	MODERATE	ABSENT	VERY THICK	WELL DEVELOPED	WELL DEVELOPED	FIBRES SLIGHTLY DIVERGING	SHORT	VERY SMALL	C	STROPHIC	—	—	CHAOTIC
9	OBTURAMENTELLA LEBANON	MEDIUM SIZE	NEARLY STRAIGHT RATHER SHORT	WELL DEVELOPED	COARSE, STARTING HALFWAY NO SPLITTING	MODERATE	ABSENT	VERY THICK	WELL DEVELOPED BILOBATE	WELL DEVELOPED	FIBRES SUBPARALLEL	SHORT	SMALL	cf.B	STROPHIC	—	X	—
10	EOGLOSSINOTOECHIA SYLPHIDEA	MEDIUM SIZE	NEARLY STRAIGHT STRONGLY PROTRUDING	LARGE	FINE, STARTING AT BEAKS, OFTEN SPLITTING	MODERATE	PRESENT	MODERATE THICKNESS	STRONGLY JUTTING	VERY WELL DEVELOPED	FIBRES SLIGHTLY DIVERGING	EXTREMELY SHORT	SMALL	B	STROPHIC	—	—	—
11	GLOSSINULUS (GLOSSINOTOECHIA) PRINCEPS	MEDIUM SIZE	NEARLY STRAIGHT STRONGLY PROTRUDING	LARGE	FINE, STARTING AT BEAKS, NO SPLITTING	LARGE	PRESENT	MODERATE THICKNESS	STRONGLY JUTTING	VERY WELL DEVELOPED	FIBRES SLIGHTLY DIVERGING	EXTREMELY SHORT	SMALL	B	STROPHIC	—	—	—
12	GLOSSINULUS (GLOSSINOTOECHIA) HENRICI	MEDIUM SIZE	NEARLY STRAIGHT STRONGLY PROTRUDING	LARGE	FINE, STARTING AT BEAKS, HARDLY SPLITTING	MODERATE	PRESENT	MODERATE THICKNESS	STRONGLY JUTTING	VERY WELL DEVELOPED	FIBRES SLIGHTLY DIVERGING	EXTREMELY SHORT	VERY SMALL	B	STROPHIC	X	—	—
13	EUCHARITINA EUCHARIS	MEDIUM SIZE	NEARLY STRAIGHT RATHER SHORT	WELL DEVELOPED	COARSE, STARTING HALFWAY NO SPLITTING	LARGE	ABSENT	THICK	WELL DEVELOPED QUADRI- OR TRIPARTITE	WELL DEVELOPED	FIBRES MODERATELY DIVERGING	EXTREMELY SHORT	MODERATE SIZE	A	STROPHIC	—	—	CHAOTIC
14	HEBETOECHIA MITIDULA	VERY COARSE	NEARLY STRAIGHT RATHER SHORT	WELL DEVELOPED	MODERATE COARSENESS STARTING HALFWAY NO SPLITTING	VERY SMALL	ABSENT	THIN	INCIPIENT	INCIPIENT OR ABSENT	FIBRES MODERATELY DIVERGING	EXTREMELY SHORT	SMALL	B	STROPHIC	—	—	—
15	UNCINULUS PILA	FINE	STRONGLY CURVED SHORT	INCIPIENT	VERY FINE STARTING NEAR BEAKS STRONGLY SPLITTING	MODERATE	CONTINUOUS HINGE PLATE	VERY THICK	WELL DEVELOPED	WELL DEVELOPED	FIBRES MODERATELY DIVERGING	≈ ZERO	≈ ZERO	C	STROPHIC	—	—	STRATIFIED
16	UNCINULUS MALEDICTUS MALEDICTUS	FINE	STRONGLY CURVED SHORT	INCIPIENT	VERY FINE STARTING NEAR BEAKS STRONGLY SPLITTING	MODERATE	CONTINUOUS HINGE PLATE	VERY THICK	WELL DEVELOPED	WELL DEVELOPED	FIBRES MODERATELY DIVERGING	≈ ZERO	≈ ZERO	C	STROPHIC	—	—	STRATIFIED
17	MARKITOECHIA MARKI	MEDIUM SIZE	NEARLY STRAIGHT RATHER SHORT	WELL DEVELOPED	MODERATE COARSENESS STARTING HALFWAY NO SPLITTING	VERY SMALL	PRESENT	VERY THICK	VERY STRONGLY JUTTING	WELL DEVELOPED	FIBRES MODERATELY DIVERGING	EXTREMELY SHORT	SMALL	cf.B	STROPHIC?	—	X	—
18	GLOSSINULUS (GLOSSINOTOECHIA) LATUS	MEDIUM SIZE	NEARLY STRAIGHT STRONGLY PROTRUDING	LARGE	FINE, STARTING AT BEAKS OFTEN SPLITTING	MODERATE	PRESENT	THICK	STRONGLY JUTTING	VERY WELL DEVELOPED	FIBRES MODERATELY DIVERGING	EXTREMELY SHORT	VERY SMALL	B	STROPHIC?	—	—	—
19	KRANSIA PARALLELEPIPEDA	VERY COARSE	NEARLY STRAIGHT RATHER SHORT	WELL DEVELOPED	MODERATE COARSENESS STARTING HALFWAY NO SPLITTING	SMALL	CONTINUOUS HINGE PLATE	THIN TO VERY THICK	WELL DEVELOPED	WELL DEVELOPED	MEDIOTEST; FIBRES STRONGLY DIVERGING	≈ ZERO	≈ ZERO	D	STROPHIC?	—	—	—
20	UNCINULUS ORBIGNYANUS	FINE	STRONGLY CURVED SHORT	INCIPIENT	VERY FINE, STARTING AT BEAKS STRONGLY SPLITTING	MODERATE	CONTINUOUS HINGE PLATE	VERY THICK	WELL DEVELOPED	WELL DEVELOPED	FIBRES MODERATELY DIVERGING	≈ ZERO	≈ ZERO	C	STROPHIC?	—	—	STRATIFIED
21	UNCINULUS KNJASPENSIS	FINE	STRONGLY CURVED SHORT	INCIPIENT	VERY FINE, STARTING NEAR BEAKS OFTEN SPLITTING	MODERATE	PRESENT	THIN TO VERY THICK	WELL DEVELOPED	WELL DEVELOPED	FIBRES MODERATELY DIVERGING	≈ ZERO	VERY SMALL	C	STROPHIC?	—	—	STRATIFIED
22	KRANSIA PRIMIPILARIS	VERY COARSE	NEARLY STRAIGHT RATHER SHORT	WELL DEVELOPED	FINE, STARTING AT BEAKS EXTREMELY SPLITTING	MODERATE	CONTINUOUS HINGE PLATE	VERY THICK	WELL DEVELOPED	WELL DEVELOPED	MEDIOTEST; FIBRES STRONGLY DIVERGING	≈ ZERO	≈ ZERO	D	STROPHIC?	—	—	—
23	KRANSIA GOLDFUSSII	VERY COARSE	NEARLY STRAIGHT RATHER SHORT	WELL DEVELOPED	COARSE, STARTING HALFWAY NO SPLITTING	MODERATE	CONTINUOUS HINGE PLATE	THICK	WELL DEVELOPED	WELL DEVELOPED	MEDIOTEST; FIBRES STRONGLY DIVERGING	≈ ZERO	≈ ZERO	D	STROPHIC?	—	—	—
24	KRANSIA MINOR MINOR	VERY COARSE	NEARLY STRAIGHT RATHER SHORT	WELL DEVELOPED	MODERATE COARSENESS STARTING HALFWAY NO SPLITTING	VERY SMALL	CONTINUOUS HINGE PLATE	THIN	WELL DEVELOPED	MODERATELY DEVELOPED	NO MEDIOTEST FIBRES SLIGHTLY DIVERGING	≈ ZERO	≈ ZERO	D	STROPHIC?	—	—	—

Enclosure II

TABLE A. NUMERICAL EXPRESSION OF CHARACTER STATES

NO. SPECIES	TIME INDEX	CHARACTERS (1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
1	0	2	1	2	3	1	2	2	1	1	1	1	1	1	1	1
2	0	2	1	2	3	1	1	1	1	1	1	1	1	1	1	1
3	12	4	3	3	2	1	1	2	3	2	1	1	1	1	1	1
4	12	3	4	2	2	4	1	2	2	3	2	1	1	1	1	1
5	18	4	4	2	3	4	1	2	2	3	1	1	1	1	1	1
6	18	3	2	4	4	1	1	1	1	2	1	1	1	1	1	1
7	21	2	2	4	4	1	3	2	1	1	2	1	4	1	1	1
8	26	1	1	1	3	1	4	3	2	1	3	3	1	1	1	3
9	31.4	2	3	4	3	1	4	3	1	1	2	2	1	1	4	1
10	36	2	4	2	3	4	2	4	2	3	2	2	1	1	1	1
11	36	2	4	2	4	4	2	4	2	3	2	2	1	1	1	1
12	36	2	4	2	3	4	2	4	2	3	3	2	1	4	1	1
13	36	2	3	4	4	1	3	3	3	3	1	1	1	1	1	3
14	36	4	3	3	1	1	1	2	3	3	2	2	1	1	1	1
15	43	1	1	1	3	2	4	3	3	4	4	3	1	1	1	4
16	45.4	1	1	1	3	2	4	3	3	4	4	3	1	1	1	4
17	49.4	2	3	3	1	4	4	4	3	3	2	2	1	1	4	1
18	49.4	2	4	2	3	4	3	4	3	3	3	2	1	1	1	1
19	52	4	3	3	2	2	3	3	4	4	4	4	1	1	1	1
20	53.6	1	1	1	3	2	4	3	3	4	4	3	1	1	1	4
21	53.6	1	1	1	3	4	3	3	3	4	3	3	1	1	1	4
22	56.8	4	3	2	3	2	4	3	4	4	4	4	1	1	1	1
23	56.8	4	3	4	3	2	3	3	4	4	4	4	1	1	1	1
24	56.8	4	3	3	1	2	1	3	2	4	4	4	1	1	1	1

TABLE B. EVALUATION OF THE DIFFERENCES IN CHARACTER VALUES

CHARACTER GROUP	DIFFERENCE	EVALUATIONS TIME INTERVAL SMALL	TIME INTERVAL MODERATE	TIME INTERVAL LARGE
(1)	ABS. VALUES 0	6	6	5
	ABS. VALUES 1	4	4	4
	ABS. VALUES 2	3	4	4
	ABS. VALUES 3	1	2	3
(2)	-3	1	2	2
	-2	3	3	3
	-1	3	3	3
	0	5	4	3
	+1	3	4	3
	+2	3	4	4
	+3	1	4	4
(3)	-3	1	1	1
	-2	2	2	2
	-1	3	3	3
	0	4	3	3
	+1	3	4	3
	+2	2	5	4
	+3	1	4	5
(4) OLDEST SPECIES / YOUNGEST SPECIES				
4 / 1		-3	-3	-2
1 / 4		-3	-2	-1
3 / 1		-2	-2	-1
1 / 3		-2	-1	0
1 / 1		0	0	0
3 / 3		+2	+2	+2
3 / 4		+3	+3	+3
4 / 4		+3	+3	+3

TABLE C. ULTIMATE CORRELATION FACTORS

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	-	56	45	42	43	43	43	45	42	41	40	41	44	41	47	47	41	44	48	47	45	50	49	45
2		-	45	42	43	43	43	45	42	41	40	41	44	41	47	47	41	44	48	47	45	50	49	45
3			-	42	43	43	37	43	43	41	41	40	44	51	41	41	40	40	48	41	39	46	46	46
4				-	51	37	32	37	36	47	47	46	38	40	39	39	40	43	44	39	39	44	43	41
5					-	37	31	25	39	50	48	49	38	43	41	40	40	45	45	40	40	47	46	43
6						-	45	30	44	42	44	41	48	45	43	43	38	41	47	43	41	47	48	43
7							-	32	42	40	42	39	48	41	40	40	37	39	43	39	37	43	44	40
8								-	38	32	30	30	37	29	54	54	37	38	39	47	46	40	39	37
9									-	36	34	32	41	35	41	41	49	43	44	41	37	44	45	40
10										-	54	52	35	36	32	32	43	52	46	42	43	50	48	43
11											-	50	37	34	30	30	41	50	46	40	42	48	46	41
12												-	31	32	30	30	40	48	42	38	39	46	44	39
13													-	38	37	37	38	41	44	45	44	44	46	40
14														-	27	27	42	39	52	40	37	50	50	53
15															-	59	30	34	36	53	50	41	38	36
16																-	30	34	36	59	53	41	38	36
17																	-	43	35	30	32	34	32	35
18																		-	37	34	40	39	38	34
19																			-	36	34	50	52	50
20																				-	53	41	36	33
21																					-	35	34	31
22																						-	51	45
23																							-	47
24																								-

TABLE D. CORRELATION OF SPECIES IN THREE GROUPS

(A)

	1	2	3	14	19	22	23	24
1	-	56	45	41	48	50	49	45
2		-	45	41	48	50	49	45
3			-	51	48	46	46	46
14				-	52	50	50	53
19					-	50	52	50
22						-	51	45
23							-	47
24								-

(B)

	4	5	10	11	12	18
4	-	51	47	47	46	43
5		-	50	48	49	45
10			-	54	52	52
11				-	50	50
12					-	48
18						-

(C)

	8	15	16	20	21
8	-	54	54	47	46
15		-	59	53	50
16			-	59	53
20				-	53
21					-

TABLE E. CORRELATION OF THREE GROUPS

(A)

	3	14	19	22	23	24
4	42	40	44	44	43	41
5	43	43	45	47	46	43
10	41	36	46	50	48	43
11	41	34	46	48	46	41
12	40	32	42	46	44	39
18	40	39	37	39	38	34

(B)

	3	14	19	22	23	24
8	43	29	39	40	39	37
15	41	27	36	41	38	36
16	41	27	36	41	38	35
20	41	40	36	41	36	33
21	39	37	34	35	34	31

(C)

	4	5	10	11	12	18
8	37	25	32	30	30	38
15	39	41	32	30	30	34
16	39	40	32	30	30	34
20	39	40	43	40	38	34
21	39	40	43	42	39	40

TABLE F. DEVELOPMENT OF CHARACTERS IN THREE LINEAGES

	MOSAICS	VENTR. UMBO/ DELTIDIUM	COSTAE	SHELL SIZE	CONNECTIVUM	POST THICKN.	CARD. PROC/ EXPANSIONS	DORS SEPTUM	HINGE LINE	SEPTALIUM	MARG. SPINES	CHAOTIC-STRATIFIED SHELL STRUCTURE	
U. SUBWILSONI	1	1	1	3	1	4	3	2	1	3	3	3	U. SUBWILSONI
U. PILA	1	1	1	3	2	4	3	3	4	4	3	4	U. PILA
U. MALEDICTUS	1	1	1	3	2	4	3	3	4	4	3	4	U. MALEDICTUS
U. ORBIGNYANUS	1	1	1	3	2	4	3	3	4	4	3	4	U. ORBIGNYANUS
U. KNJASPENSIS	1	1	1	3	4	3	3	3	4	3	3	4	U. KNJASPENSIS
E. CACUMINATA	3	4	2	2	4	1	2	2	3	2	1	1	E. CACUMINATA
E. MYSTICA	4	4	2	3	4	1	2	2	3	1	1	1	E. MYSTICA
E. SYLPHIDEA	2	4	2	3	4	2	4	2	3	2	2	1	E. SYLPHIDEA
G. (G.) PRINCEPS	2	4	2	4	4	2	4	2	3	2	2	1	G. (G.) PRINCEPS
G. (G.) HENRICI	2	4	2	3	4	2	4	2	3	3	2	1	G. (G.) HENRICI
G. (G.) LATUS	2	4	2	3	4	3	4	3	3	3	2	1	G. (G.) LATUS
H. HEBE	4	3	3	2	1	1	2	3	2	1	1	1	H. HEBE
H. NITIDULA	4	3	3	1	1	1	2	3	3	2	2	1	H. NITIDULA
K. PARALLEPIPEDA	4	3	3	2	2	3	3	4	4	4	4	1	K. PARALLELEPIPEDA
K. PRIMIPILARIS	4	3	2	3	2	4	3	4	4	4	4	1	K. PRIMIPILARIS
K. GOLDFUSSII	4	3	4	3	2	3	3	4	4	4	4	1	K. GOLDFUSSII
K. MINOR	4	3	3	1	2	1	3	2	4	4	4	1	K. MINOR