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An integrated inoceramid-foraminiferal biostratigraphy of the Turonian and Coniacian strata in south-western Crimea, Soviet Union

ABSTRACT: The inoceramid and the foraminiferal zonation within the Turonian and Lower Coniacian sequence of south-western Crimea (Soviet Union), based on the material from the Aksu-Dere sections are analyzed. The traditional Inoceramus labiatus Zone is subdivided into the Mytiloides mytiloides Zone and the Mytiloides hercynicus Zone. Within the Inoceramus woodsi (=costellatus) Zone of the Upper Turonian commonly used in the Soviet Union, the I. costellatus, the Cremnoceramus? waltersdorfensis, and the C. rotundatus Zone are recognized, and the Turonian/Coniacian boundary is placed at the base of the latter. Taxonomy of the selected inoceramid species is shortly discussed.

INTRODUCTION

The paper presents the results of the stratigraphic investigations of the Turonian and Coniacian strata in the Aksu-Dere sections (Text-figs 1-2) in the south-western part of the mountaineous Crimea, Soviet Union. These sections, the most complete in the region provide an opportunity of detailed studies of macrofaunal distribution and sampling for microfauna. The supplementary materials and data from other exposures in the closest environs are also included.

This paper is the first report of the common works on the detailed correlation program of the Upper Cretaceous deposits between southern part of the Soviet Union and the extra-Carpathian Cretaceous of Poland, undertaken by the Geological Faculties of the Moscow and the Warsaw Universities. This Program is headed by Professor D. P. NAIDIN, of the University of Moscow and Ass.-Professor R. MARCINOWSKI of the University of Warsaw.

The Upper Cretaceous strata of the Crimea were studied already far back in the nineteenth century (*see* MASLAKOVA & VOLOSHINA 1969, *and* MURATOV 1973 for detailed review). The first biostratigraphic background was given by WEBER & MALYSHEFF (1923), and their scheme was supplemented and/or revised in many subsequent papers (KELLER 1951, MASLAKOVA & VOLOSHINA 1969, MASLAKOVA 1958, MOSKVIN 1959, MURATOV 1973). Recently, an extensive account on the stratigraphy of the lower part of the Upper Cretaceous in the studied area was presented by NAIDIN & *al.* (1981). The Turonian to Santonian deposits in the area further to SW were studied by KLIKUSHIN (1985).

GEOLOGICAL SETTING

The studied area constitutes a part of the mountaineous Crimea. Geomorphologically, the Crimean Mountains, occupying the southern part of the peninsula (Text-fig. 1), consist of three ranges, from south to north as follows: the Major, the Second (= Piedmont), and the Outer Ridges.

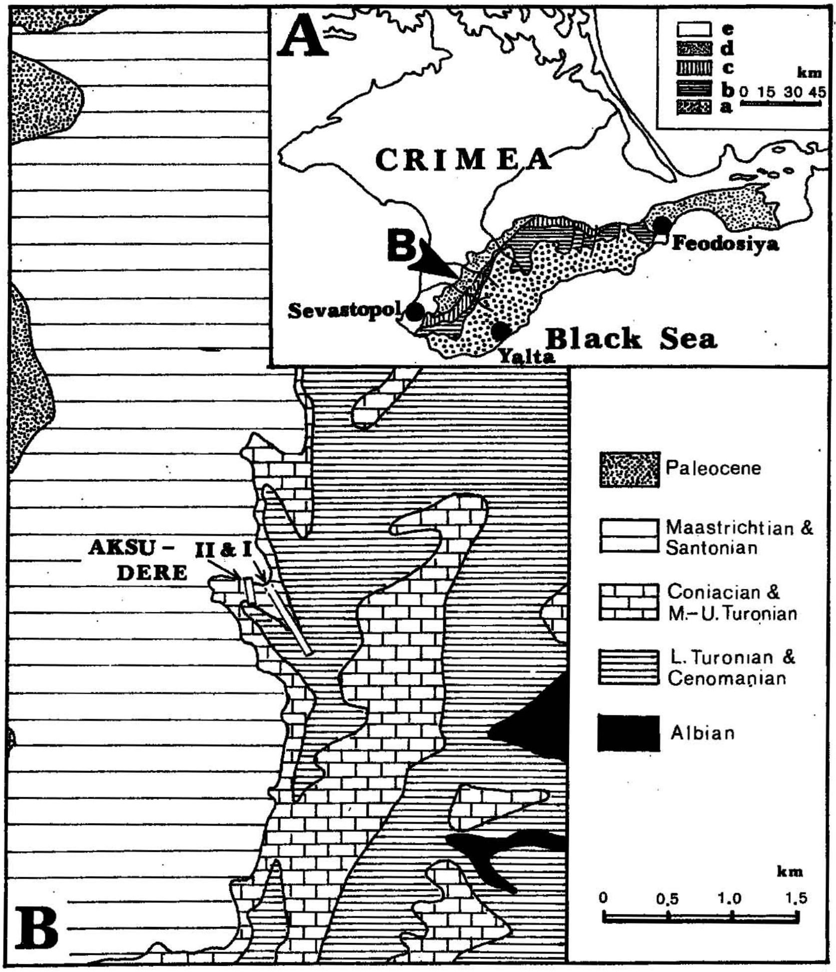


Fig. 1. Geologic setting of the Aksu-Dere sections in the Crimea, Soviet Union

A — Sketch-map of the Crimea penninsula (*after* NAIDIN 1981, slightly simplified: **a** — Upper Triassic — Jurassic; **b** — Lower Cretaceous; **c** — Upper Cretaceous; **d** — Paleogene; **e** — Neogene

B — Sketch-map of the studied area

Structurally, they form a megaanticline, with Triassic and Jurassic deposits of the Major Ridge exposed along its axial part, and the Cretaceous and Paleogene deposits of the Piedmont and Outer Ridges building its northern limb.

Upper Cretaceous deposits of the Piedmont Ridge occur in a norrow belt, stretching approximately SW — NE from environs of Sevastopol to Feodosiya (Text-fig. 1). These deposits dipping slightly to north and northwest, with maximum thickness of about 450—480 m pass further on to the north into the Cretaceous deposits of the Crimean Plain (MURATOV 1973, NAIDIN 1982).

CENOMANIAN/TURONIAN BOUNDARY

In the Aksu-Dere sections the rhythmically bedded Upper Cenomanian marls are overlain in sedimentary continuity by the Lower Turonian rocks (Text-fig. 2). The boundary is however well marked by the appearance of the so-called „black band" represented here by dark marly clays with silt-size quartz, glauconite and volcanic material, and with almost complete lack of both macro- and microfaunal calcitic remains. This „black band" well corresponds to the Oceanic Anoxic Event widely noted at the Cenomanian/Turonian boundary (*see e.g.* JENKYNS 1980, 1985; HART & BIGG 1982; de BOER 1983), and its time equivalence is here well evidenced by the studies of foraminifers (Text-fig. 3). Namely, this unit falls within time interval between the last occurrence of *Rotalipora cushmani* (MORROW) and the first appearance of *Helvetoglobotruncana helvetica* (BOLLI). Moreover, in the first Turonian sample close to the Cenomanian boundary there occur already *Whiteinella archeocretacea* PESSAGNO and the first but already frequent *Dicarinella hagni* (SCHEIBNEROVA). This interval between the last occurrence of *Rotalipora cushmani* (MORROW) and the first occurrence of *Helvetoglobotruncana helvetica* is included here into Dicarinella hagni Zone (*see* Text-fig. 3), corresponding to the Whiteinella archeocretacea Zone of other authors (*e.g.* ROBASZYNSKI & *al.* 1980, 1982). An almost identical sequence of foraminiferal assemblages around the Cenomanian/Turonian boundary was observed in many European sections with the complete boundary succession (ROBASZYNSKI & *al.* 1980, 1982; HILBRECHT 1987; JARVIS & *al.* 1988a, b).

In other sections within the studied area the Cenomanian/Turonian boundary is usually combined with stratigraphic gaps. It is well illustrated by the section of Mender-Hill where the stratigraphic gap, confined to the hardground horizon, comprises the whole Dicarinella hagni Zone (*see* NAIDIN & *al.* 1981).

TURONIAN — LOWER CONIACIAN

LITHOLOGY

Overlying the boundary „black band" is ca. 20 m succession of thinly bedded, grey marls passing gradually upwards into light grey limy marls and marly limestones of Lower (and ?Middle) Turonian age. The lower part of the marls is cut by two discontinuity surfaces: a minute omission surface about 1.4

m above the boundary, and an incipient hardground (following the classification of KENNEDY & GARRISON 1975) about still 2 m higher. In the upper half of the unit light flints start to occur (Text-fig. 2).

Following the marly limestone unit there occurs an 18 m thick Stylolitic Limestone Unit composed of white, hard, calcisphaerid-foraminiferal micritic limestones of Middle Turonian to Lower Coniacian age (Text-figs 2-3). The unit is capped by the incipient hardground with the cemented part of about

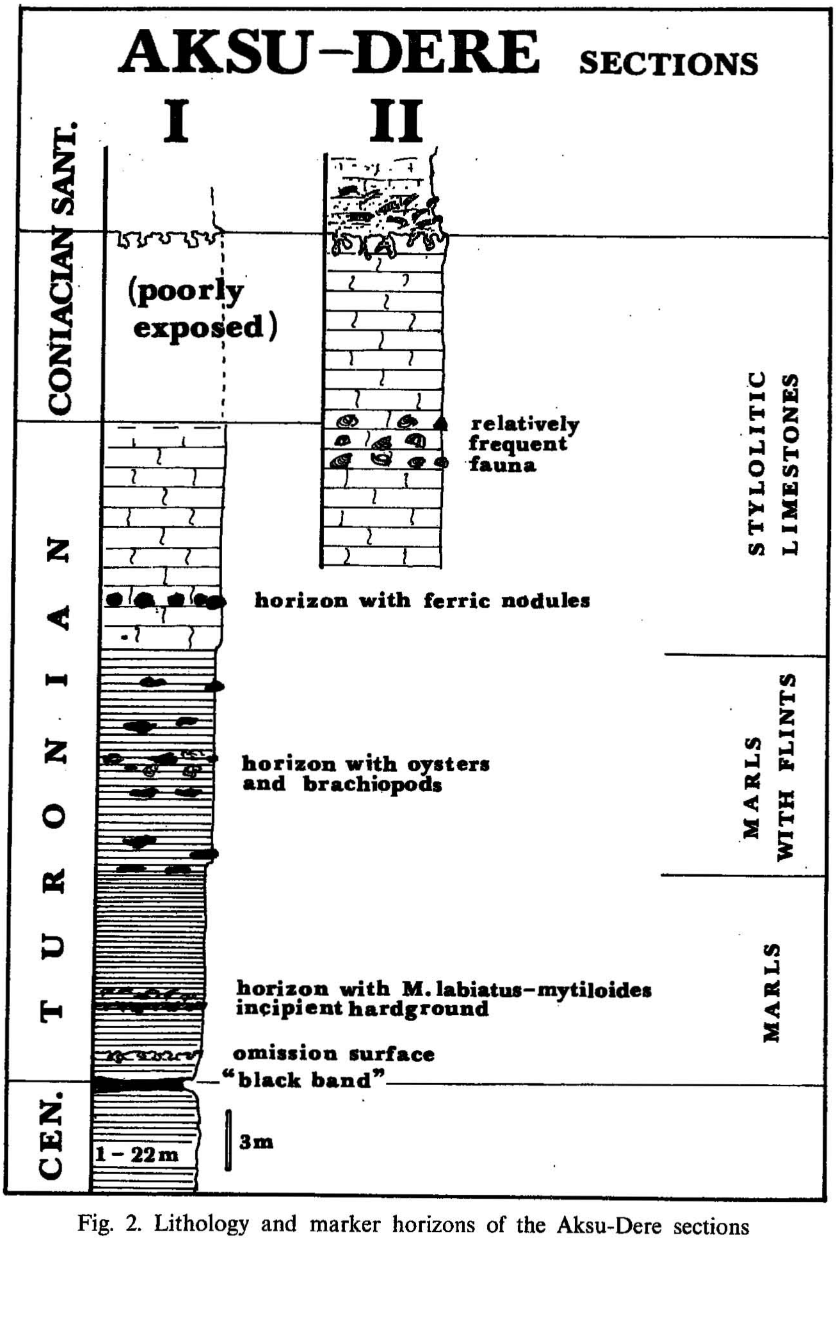
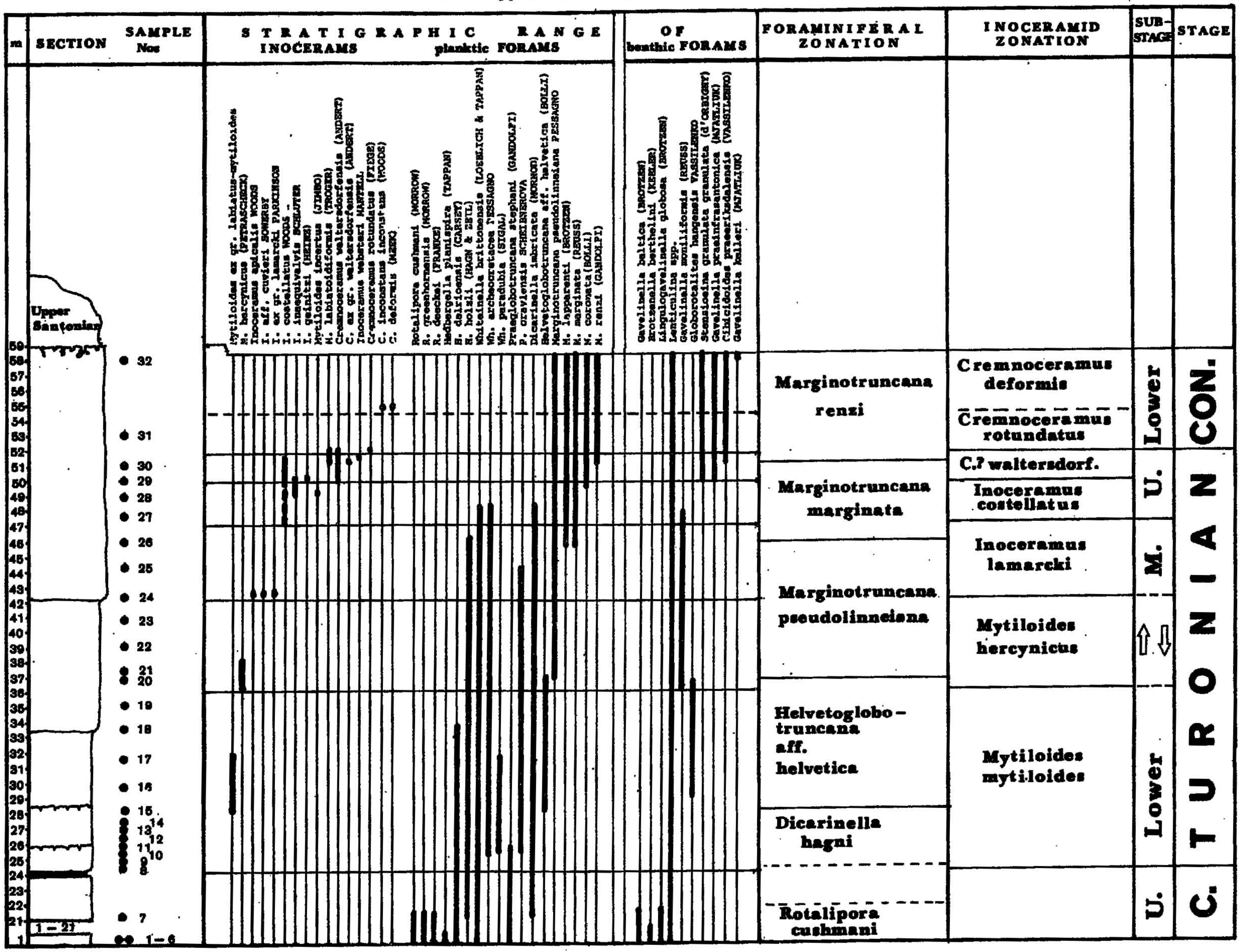


Fig. 2. Lithology and marker horizons of the Aksu-Dere sections

Biostratigraphy of the Aksu-Dere sections, based on inoceramids and foraminifers

U. — Upper, M. — Middle, C. — Cenomanian



10—20 cm, planar upper surface and distinct *Thalassinoides*-type burrows, descending to about 20—30 cm down. The burrows are of diameter 2—3 cm and possess weakly glauconitized walls.

The limestone unit is overlain by detrital limestones and marls of Upper Santonian age.

The sparse fossils comprise inoceramids, echinoids, brachiopods and extremely rare ammonites. An increased frequency of fauna (mainly of inoceramids) is observed only in a 2 m thick interval about 8 m above the bottom of the unit, around the Turonian/Coniacian boundary (Text-fig. 2).

STRATIGRAPHY

The Marls and Marls with flints Units belong, in ascending order, to the Mytiloides mytiloides Zone and the M. hercynicus Zone (*see* Text-fig. 2-3). The more refined zonation based on the supposed, successive appearance of particular forms from the *Mytiloides labiatus* lineage, as suggested by KAUFFMAN (1976, *and* KAUFFMAN *in*: KAUFFMAN & *al.* 1976, 1977; WIEDMANN & KAUFFMAN 1976) and supported also by TRÖGER (1981) can not be tested on the studied material due to its poor preservation (*see* Pl. 1, Figs 1-4) and uncomplete record in the section (Text-fig. 3) KAUFFMAN's zonation was questioned however by KELLER (1982), ERNST & *al.* (1983) and HILBRECHT (1986) basing on the observations from northern and southern Germany. These authors showed many species regarded by KAUFFMAN as index forms of the successive zones to cooccur just close to the Cenomanian/Turonian boundary. Of importance are also the data of SORNAY (*in*: ROBASZYNSKI & *al.* 1980, 1982) and BADILLET & SORNAY (1980) stating a mosaic occurrence of particular low-Turonian *Mytiloides* species within the Lower Turonian of the stratotypic area, negating so even the possibility of the bipartite division. The twofold zonation as recognized in the studied sections was revealed however in Germany (KELLER 1982) and also in Poland. To what extent these discrepancies are a consequence of different species concept, condensation phenomena, as supposed by TRÖGER (1981) and ERNST & *al.* (1984), or result from a real distribution pattern of nothing more but ecologic forms needs further testing.

The correlation of the distinguished inoceramid zones with a standard ammonite division is also far from a final acceptance. Traditionally, both the Mytiloides mytiloides and M. hercynicus Zones were regarded as of Lower Turonian age with the Lower/Middle Turonian boundary placed at the base of the succeeding Inoceramus lamarcki Zone (*e.g.* SEITZ 1952, TRÖGER 1967). However, the contemporaneous entrance level of the Middle Turonian ammonite index species *Collignoniceras woolgari* (MANTELL) and *Mytiloides hercynicus* (PETRASCHECK) was shown to be a case in many areas (*see* KAUFFMAN 1976; KAUFFMAN & *al.* 1976, 1977; WIEDMANN & KAUFFMAN 1976; *see also discussion in*: SEIBERTZ 1979; TRÖGER 1981, 1989). Consequently, the

Lower/Middle Turonian boundary should be placed at the base of the M. hercynicus Zone. Two problems arise, however, when accepting such a correlation. The first is the cooccurrence of *M. hercynicus* (PETRASCHECK) still with *Mammites nodosoides* (SCHLOTHEIM), an ammonite index of the Lower Turonian, noted by KELLER (1982) in northern Germany; the second is the intimate problems of the low-Turonian zonation based on the *Mytiloides*, as discussed above. In this paper the problem is left as an open question with two possibilities indicated (*see* Text-figs 3 and 5).

The lower part of the succeeding Stylolitic Limestone Unit, up to the interval with relatively frequent fauna (Text-fig. 2) represents the Middle Turonian Inoceramus lamarcki Zone and the I. costellatus Zone and the Cremnoceramus? waltersdorfensis Zóne of the Upper Turonian (*see* Text-figs 3 and 5). The Middle/Upper Turonian boundary is placed here at the entrance level of *Inoceramus* ex gr. *costellatus* WOODS which was shown (*see* KELLER 1982, ERNST & *al.* 1983, WOOD & *al.* 1984) to possesses an almost simultaneous entrance level with the Upper Turonian index ammonite species *Subprionocyclus neptuni* (GEINITZ).

In the Inoceramus lamarcki Zone only single inoceramids were collected in the studied sections. These bedly preserved specimens comprise *Inoceramus apicalis* WOODS, *I.* aff. *cuvieri* SOWERBY and *I.* ex gr. *lamarcki* PARKINSON. Similarly, in the Inoceramus costellatus Zone, where beside an index form the only *Inoceramus* ex gr. *inaequivalvis* SCHLÜTER was found (*see* Pl. 3, Fig. 5). Two other forms indicated on the range chart (*see* Text-fig. 3), i.e., *Inoceramus lusatiae* ANDERT (*see* Pl. 3, Fig. 1) and *Mytiloides incertus* (JIMBO) (*see* Pl. 1, Fig. 5), are without precise location in the studied section and may likely be derived from any higher horizon (C.? waltersdorfensis or C. rotundatus Zone).

The most diversified inoceramid assemblage is yielded by the Cremnoceramus? waltersdorfensis Zone, the lower boundary of which coincides with the Turonian/Coniacian boundary interval with relatively frequent fauna. The inoceramid assemblage of this Zone is represented by *Inoceramus costellatus* WOODS (*see* Pl. 2, Fig. 2), *Inoceramus* aff. *glatziae* (*sensu* ANDERT, 1934) (*see* Pl. 2, Fig. 1), *Cremnoceramus*? *waltersdorfensis* (ANDERT), *C.*? ex gr. *waltersdorfensis* (ANDERT) (*see* Pl. 3, Fig. 2), *Inoceramus* ex gr. *inaequivalvis* SCHLÜTER (*see* Pl. 3, Fig. 4 and Pl. 5, Fig. 2), *Inoceramus geinitzi* (HEINZ) (*see* Pl. 2, Fig. 5), *I. websteri* MANTELL (*see* Pl. 3, Fig. 3), and *Mytiloides labiatoidiformis* (TRÖGER) (*see* Pl. 3, Fig. 4).

The topmost part of the boundary interval with frequent fauna and the overlying part of the Stylolitic Limestones Unit, up to its boundary with the Upper Santonian deposits belong to the Coniacian (*see* Text-fig. 2). The lower boundary of this stage is placed at the appearance level of *Cremnoceramus rotundatus* (FIEGE) which is assumed to correlate with the entry of *Forresteria petrocoriensis* (COQUAND), an ammonite index of the Lower Coniacian (*see* KAUFFMAN 1976, KAUFFMAN & *al.* 1976, SEIBERTZ 1979, ERNST & *al.* 1983, MATSUMOTO 1984, KÜCHLER & ERNST 1989, TRÖGER 1989).

Two inoceramid zones were recognized within the Coniacian of the studied sections, *i.e.* the Cremnoceramus rotundatus Zone, characterized beside the index species (*see* Pl. 2, Fig. 3) by single specimens of *C.? waltersdorfensis* (ANDERT) and *Mytiloides labiatoidiformis* (TRÖGER), and the Cremnoceramus deformis Zone documented by an outer mould of the nominative species and two specimens of *Cremnoceramus inconstans inconstans* (WOODS) (*see* Pl. 4, Figs 1-2). A rich inoceramid fauna from the latter Zone was formerly collected in temporary exposure north of the Aksu-Dere sections and kindly submitted to investigations by Professor D. P. NAIDIN. This collection contains: *Cremnoceramus deformis* (MEEK) (*see* Pl. 4, Fig. 4), *Inoceramus ernsti* HEINZ (*see* Pl. 3, Fig. 6), *I.* aff. *wandereri* ANDERT (*see* Pl. 4, Fig. 3), and *I.* cf. *macoveii* SZASZ (*see* Pl. 5, Fig. 1).

The range of both, Cremnoceramus rotundatus and C. deformis Zones in chronostratigraphic scheme is limited to the Lower Coniacian. MASLAKOVA (1958) reported from the studied region also *Inoceramus* cf. *involutus* SOWERBY which suggests the presence of the Middle Coniacian (Upper Coniacian in the traditional Soviet division); however, her determination was objected by KOTSUBINSKY (1969). Thus, the presence of any Coniacian zone higher than the Cremnoceramus deformis Zone is here unclear.

There is still no commonly accepted foraminferal zonation within the Turonian — Lower Coniacian interval. Some horizons however, at least in Europe, are advocated by many workers (*e.g.* ROBASZYNSKI & *al.* 1980, 1982; and literature cited herein) to be almost isochronous and of a high correlation potential. Those recognized also in the Crimean studied sections comprise: (1) the common entrance level of the genus *Dicarinella* in the lowermost Turonian, (2) the entrance level of *Helvetoglobotruncana helvetica* (BOLLI) and *Globorotalites hangensis* VASSILENKO higher in the Lower Turonian, (3) the common appearance level of the first representatives of *Marginotruncana* and *Gavelinella moniliformis* (REUSS) in the Middle Turonian, and (4) the appearance level of plano-convex marginotruncanids with *Gavelinella vombensis* BROTZEN in the uppermost Turonian. The revealed horizons allow to distinguish five foraminiferal zones in the studied sections (*see* Text-fig. 3).

COMMENTS ON SOME INOCERAMID SPECIES

Almost all inoceramid species occurring in the studied area are common to the whole North European Province (*sensu* KAUFFMAN 1973, TRÖGER 1989). The similarity of inoceramid fauna, as also of ammonites and belemnites, between the Russian Platform and Central and Western Europe was already pointed out by NAIDIN (1969) and carefully studied, in the case of inoceramids, by TRÖGER (1978). The only differences of the investigated sections when compared to Central Europe concern the Lower Coniacian fauna and the mutual frequency of particular species within the Turonian/Coniacian boundary interval. In Central Europe the boundary interval is dominated by

Cremnoceramus? *walterdorfensis* (ANDERT), *C. rotundatus* (FIEGE) and by not definitely understood uppermost Turonian alate forms (*Inoceramus* aff. *frechi* assemblage of ERNST & *al.* 1983), what is not observed in the studied sections. In the Lower Coniacian this differentiation is more easy to decipher. In the studied area there occurs *Inoceramus gradatus* EGOJAN (*cf.* TRÖGER's determination *in* NAIDIN & *al.* 1981), the form unknown from Central or Western Europe (TRÖGER 1981, 1989). Moreover, the species *Inoceramus wandereri* ANDERT widely distributed in the Crimea or further to East in Caucasus and West Kazakhstan (*see* DOBROV & PAVLOVA *in*: MOSKVIN 1959; NAIDIN & *al.* 1984), is extremely rare in the western part of the North European Province (TRÖGER 1989).

Some of the poorly known and controversial taxa from the uppermost Turonian and lowermost Coniacian are shortly commented below.

Inoceramus geinitzi (HEINZ)

HEINZ (1932) established *Sphaeroceramus geinitzi* on the form illustrated by GEINITZ (1870-75, Pl. 13, Fig. 8) and referred by him to *Inoceramus cuvieri* SOWERBY. HEINZ' species was included into the synonymy of *Inoceramus costellatus* WOODS by TRÖGER (1967) and KELLER (1982) and the type specimen of GEINITZ was earlier included into *I. costellatus* WOODS by FIEGE (1930). However, basing on the differences in sculpture (greater distances between rugae and marked growth lines in interspaces) and the growth axis markedly curved to the anterior side, it seems justifiable to retain *Inoceramus geinitzi* (HEINZ) as a distinct species, but closely allied to *I. costellatus* WOODS. To this species probably also belongs the form described by KELLER (1982, Pl. 7, Fig. 1) as *Inoceramus frechi* FLEGEL. The latter species is poorly known indeed but, as it may be judged on the illustration of the form presented by SCUPIN (1912—13, Pl. 11, Fig. 9), chosen by BRÄUTIGAM (1962) as the lectotype of FLEGEL's species, it is a quite different form. It possesses straight growth axis, a relatively large posterior wing, well separated from the disc by an auricular sulcus, and the rugae on the wing markedly curved outwardly.

The species Inoceramus geinitzi (HEINZ) represents probably an evolutionary link between *Inoceramus costellatus* WOODS and *Inoceramus websteri* MANTELL.

Cremnoceramus? ex gr. *waltersdorfensis* (ANDERT)

Besides typical representatives of *Cremnoceramus*? *waltersdorfensis* (ANDERT) one specimen was found (*see* Pl. 3, Fig. 2) differring from any of the known subspecies of this species by its sculpture which consists of irregular rugae, strong, raised growth lines, and by its tendency to an outward curving of the sculpture elements on the posterior wing. A similar form from Waltersdorf (Saxony) was reported by ANDERT (1934, Pl. 4, Fig. 8a, b), but referred to as *Inoceramus protractus* SCUPIN. As a differring trait between *I. waltersdorfensis* ANDERT and the cited specimen ANDERT (1934) underlined the lack, in a case of the latter, of a geniculation. This is, however, well seen on the illustration presented by ANDERT, showing clear slope change similarly as in *C.*? *waltersdorfensis*, and so it should be included into a range of this latter species.

Cremnoceramus inconstans inconstans (WOODS)

Due to a lack of a designated lectotype and wide spectrum of forms included by WOODS (1911) into *Inoceramus inconstans* this species was very differently interpreted (*see e.g.* discussion *in*: ANDERT 1913, 1934; FIEGE 1930; TRÖGER 1967; SZASZ 1985), and it has already been suggested by

WOODS himself that it probably contains many distinct species. TRÖGER (1967) appointed as the lectotype of the nominative subspecies *Inoceramus inconstans inconstans* WOODS the original of *Inoceramus* sp. of MANTELL (1822, Pl. 27, Fig. 9; illustrated later by WOODS 1911, Text-fig. 42) regarded by WOODS as one of the types of his species. When studying the plaster cast of the lectotype (Text-fig. 4), kindly sent by Professor W. J. KENNEDY, University of Oxford, it appeared however, that diagnosis of *Inoceramus inconstans inconstans* given by TRÖGER (1967) as also the illustrated specimen from Brandenburg, included by him to this subspecies (TRÖGER 1967, Pl. 13, Fig. 19) do not correspond evidently to the indicated lectotype.

The original of the MANTELL's specimen (*see* Text-fig. 4) shows, in the early stage, an elongated ovate form with the rounded anterior and ventral margins, and with a pointed beak, insignificantly

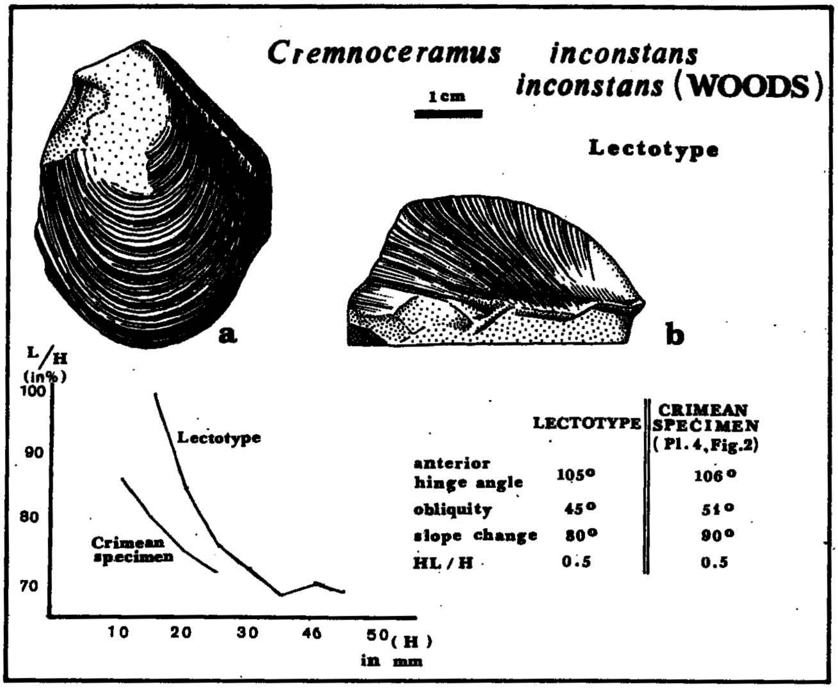


Fig. 4. Lateral (a) and anterior (b) views of the lectotype of *Cremnoceramus inconstans inconstans* (WOODS), based on the plaster cast of the MANTELL's specimen, and the ontogenic change of L to H and some measurements of the lectotype and Crimean specimen (*see* Pl. 4, Fig. 2)

projecting above the hinge line; moreover, it displays a narrow, elongated, subtriangular posterior wing separated from the disc by a shallow auricular sulcus; its hinge line is straight, moderately long. Early stage is slightly convex with maximum inflation dorsocentral, and covered with somewhat asymmetric rugae with growth lines over and between them. The distance between successive rugae is 3 — 4 mm in central and ventral parts. The adult stage, covered with growth lines only, is almost perpendicular to the early one.

The ontogenic change of L to H in the lectotype (*see* Text-fig. 4) markedly differs from the L/H values in the specimen ascribed to *I. inconstans inconstans* by TRÖGER (1967, enclosure 32). Similarly the obliquity, which is much lower in the MANTELL's specimen. Most probably the form illustrated by TRÖGER (1967, Pl. 13, Fig. 19) should be referred to any other species and it seems to belong to *Cremnoceramus*? *waltersdorfensis* (ANDERT).

Inoceramus cf. *macoveii* SZASZ

In his extensive work on the Lower Coniacian inoceramids from Romania, SZASZ (1985) illustrated one, massively vaulted specimen with the well separated posterior auricle, and determined by him as a new species, *Inoceramus macoveii*. The Crimean specimen (*see* Pl. 5, Fig. 1) is very similar to the Romanian form, but due to its poor preservation, the ultimate determination is impossible.

FINAL REMARKS

Almost all the inoceramid and foraminiferal species recorded in the studied area of the Crimea are widely spread also within the whole Central and Western Europe which allow to apply an uniform biostratigraphic scheme in all these regions. The inoceramids of the studied area when compared to those of Central Europe are rather sparse in the Turonian — Lower Coniacian interval. In spite of this, however, the trend in changing abundancy is similar in both areas, with the most frequent fauna within the M. mytiloides Zone and within the interval close to the Turonian/Coniacian boundary. In the studied sections one can hardly say however about any ecoevents (mass occurrences) as recognized in Germany (ERNST & *al.* 1983) or Poland (WALASZCZYK 1988). Most probably these events are basin-limited phenomena and are confined to the Central European Basin.

The inoceramid zonation applied in this paper, when compared to that traditionally used in the Soviet Union differs mainly around the Turonian/Coniacian boundary (*see* Text-fig. 5). The Inoceramus costellatus Zone as defined here comprises the lower part of I. costellatus (=woodsi) Zone in its traditional usage, while its upper part may be subdivided into the

TRADITIONAL SOVIET DIVISION		THIS PAPER	
substage	inoceramid zonation	inoceramid zonation	substage
LOWER CONIACIAN	Inoceramus deformis	Cremnoceramus deformis	LOWER CONIACIAN
UPPER TURONIAN	Inoceramus woodsi (=costellatus)	Cremnoceramus rotundatus	
		Cremnoceramus? waltersdorfensis	UPPER TURONIAN
		Inoceramus costellatus	
	Inoceramus lamarcki	Inoceramus lamarcki	MIDDLE TURONIAN
LOWER TURONIAN	Inoceramus labiatus	Mytiloides hercynicus	
		Mytiloides mytiloides	LOWER TURONIAN

Fig. 5. Comparison of the traditional Soviet division (*after* NAIDIN & *al.* 1981) and actually applied inoceramid zonation and chronostratigraphy in the Aksu-Dere sections

Cremnoceramus? waltersdorfensis and the C. rotundatus Zones (*see* Text-fig. 5). These two zones, distinguished in many areas of Central Europe (ERNST & *al.* 1983, WALASZCZYK 1988) as well as in Spain (KÜCHLER & ERNST 1989), are traceable also in the Caucasus (Dzhengutay section in the Dagestan). As judging from the range chart presented by NAIDIN & *al.* (1984) these two zones are easy to distinguish also as far as in the western Kazakhstan.

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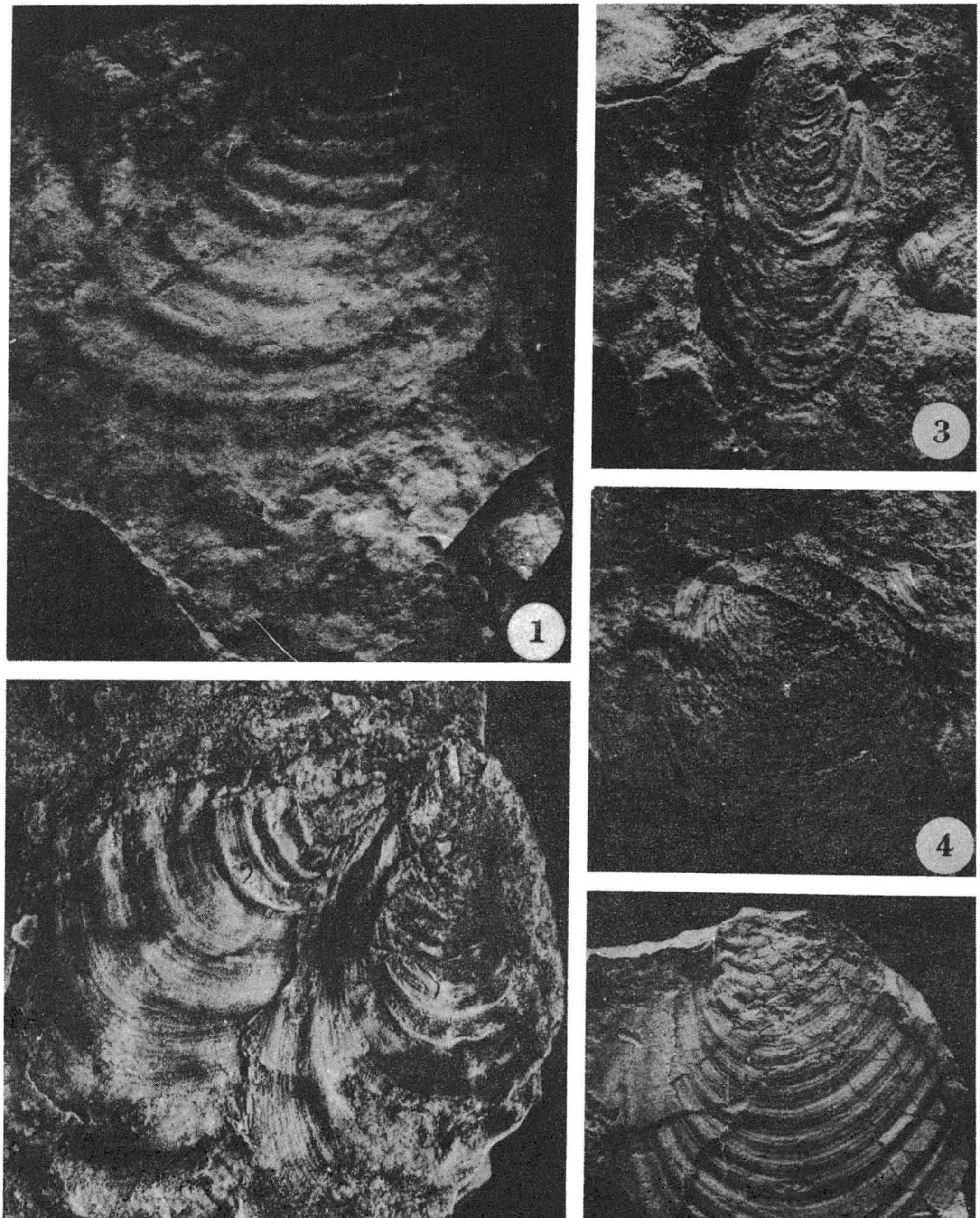
BIOSTRATYGRAFIA OSADÓW TURONU I KONIAKU POŁUDNIOWO-ZACHODNIEGO KRYMU

(Streszczenie)

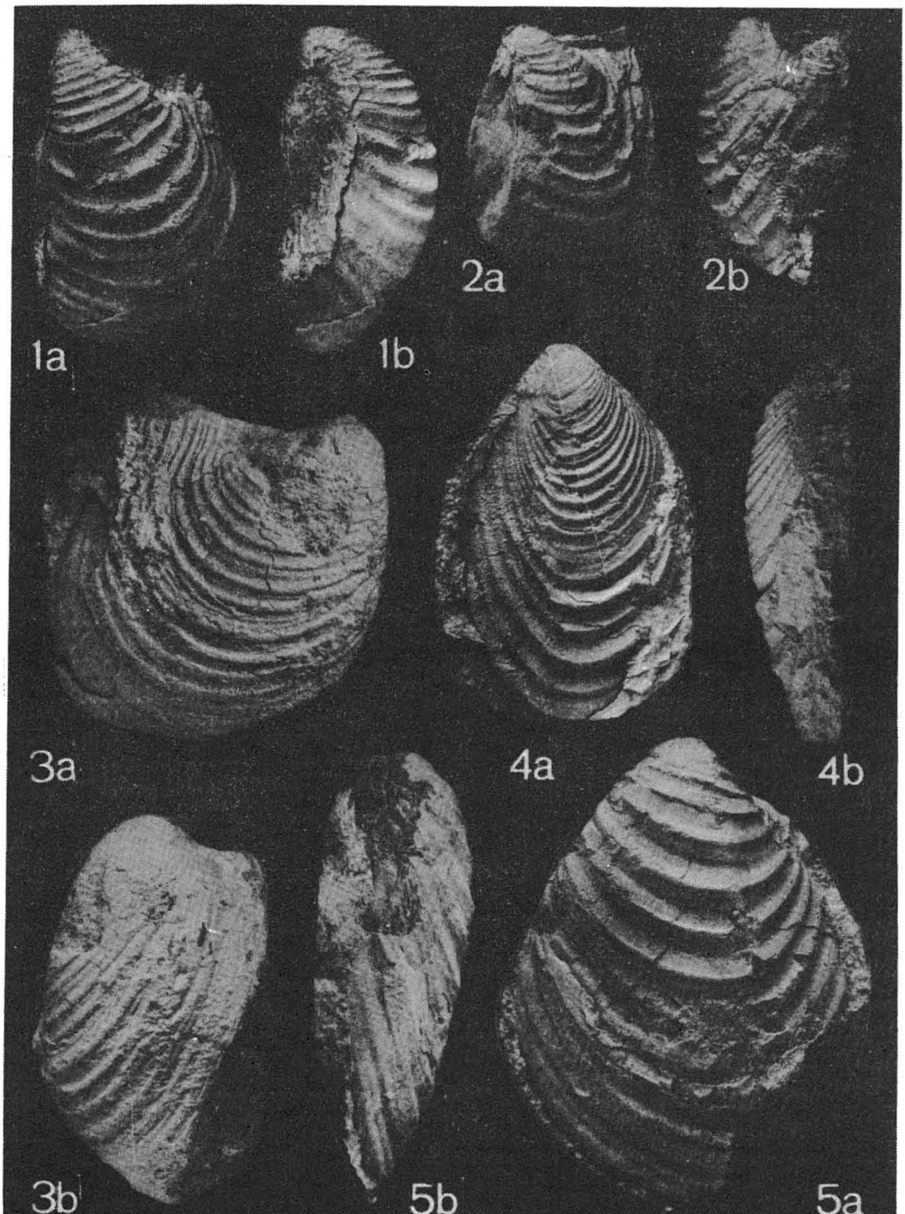
W pracy przedstawiono schemat biostratygraficzny dla osadów turonu i koniaku SW części Krymu, na przykładzie profilu Aksu-Dere (*patrz* fig. 1). W badanej, marglisto-wapiennej sekwencji miąższości około 35m (*patrz* fig. 2) wydzielono 7 poziomów inoceramowych oraz 5 poziomów otwornicowych, reprezentujących cały turon i dolny koniak w standardowym podziale stratygraficznym kredy górnej (*patrz* fig. 3 oraz 5). W obrębie tradycyjnego poziomu Inoceramus labiatus wydzielono poziomy Mytiloides mytiloides oraz M. hercynicus. Tradycyjny poziom I. woodsi (=costellatus) obejmuje wyróżniane powszechnie w Europie Środkowej i Zachodniej poziomy I. costellatus, Cremnoceramus? waltersdorfensis oraz C. rotundatus. Spąg tego ostatniego wyznacza jednocześnie granicę turon/koniak (*patrz* fig. 3 oraz 5).

Notowane w turonie i dolnym koniaku Krymu zespoły inoceramowe i otwornicowe (*patrz* fig. 3—4 oraz pl. 1—5) reprezentowane są prawie wyłącznie przez gatunki występujące w analogicznym interwale stratygraficznym Europy Środkowej i Zachodniej. Drobne różnice faunistyczne rejestrowane są jedynie wśród dolnokoniackich inoceramów (*por.* TRÖGER 1989).



1 — *Mytiloides* aff. *subhercynicus* (Seitz), right valve; M. hercynicus Zone, Aksu-Dere section *I*
2 — *Mytiloides* ex gr. *mytiloides* — *labiatus*, right and left valves; M. mytiloides Zone, Aksu-Dere section *I*
3 — *Mytiloides mytiloides* (Mantell), left valve; M. mytiloides Zone, Aksu-Dere section *I*
4 — *Mytiloides hercynicus* (Petrascheck), right valve; M. hercynius Zone, Aksu-Dere section *I*
5 — *Mytiloides incertus* (Jimbo), right valve; probably I. costellatus Zone, Aksu-Dere section *II*

All figures in natural size



1 — *Inoceramus* aff. *glatziae* FLEGEL (*sensu* ANDERT 1934), left valve: *1a* lateral, *1b* anterior view; C.? waltersdorfensis Zone, Aksu-Dere section *II*

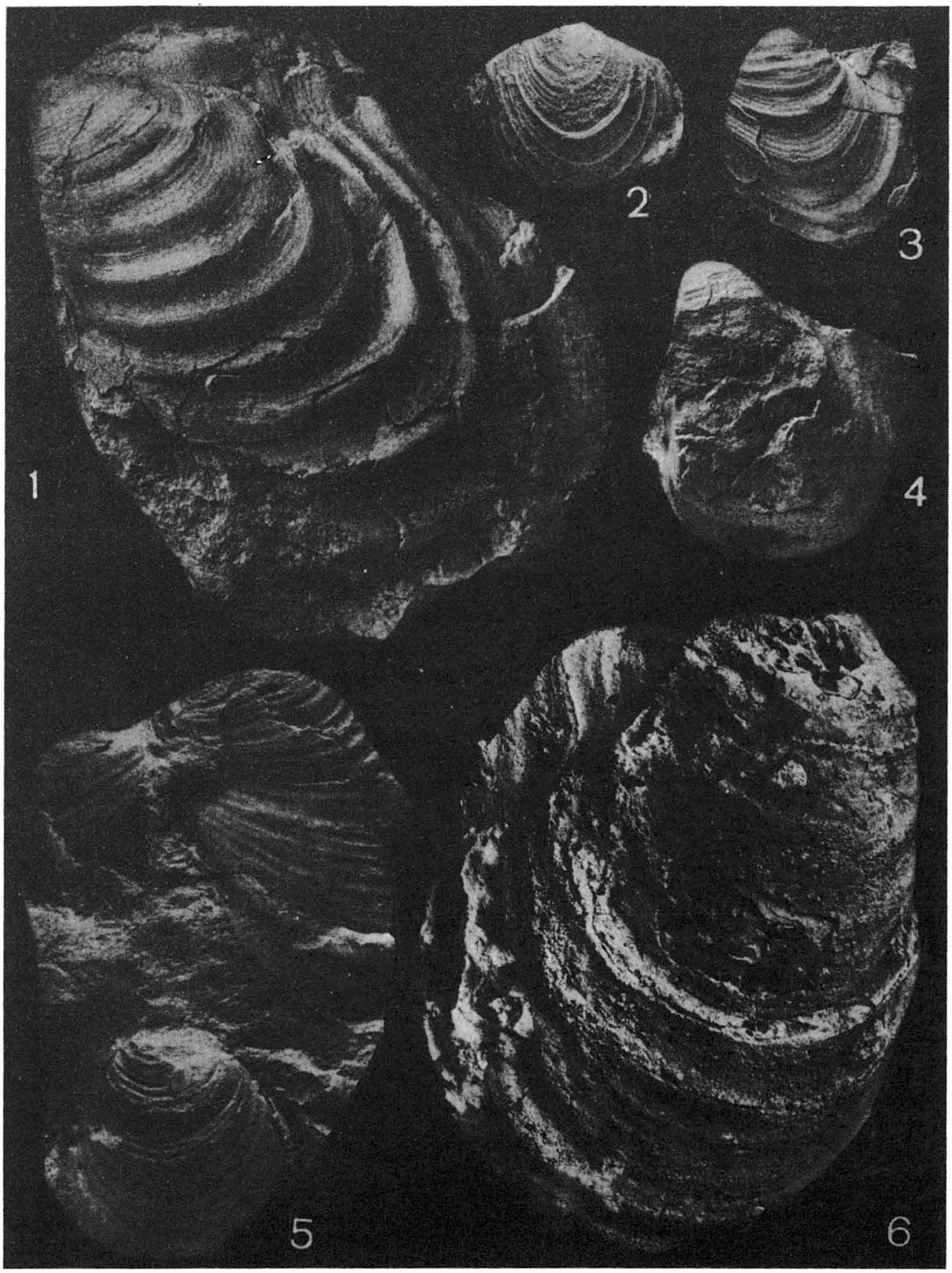
2 — *Inoceramus costellatus* WOODS, left valve: *2a* lateral, *2b* posterior view; C.? waltersdorfensis Zone, Aksu-Dere section *II*

3 — *Cremnoceramus rotundatus* (FIEGE), right valve: *3a* lateral, *3b* anterior view; C. rotundatus Zone, Aksu-Dere section *II*

4 — *Mytiloides labiatoidiformis* (TRÖGER), right valve: *4a* lateral, *4b* anterior view; C.? waltersdorfensis Zone, Aksu-Dere section *II*

5 — *Inoceramus geinitzi* (HEINZ), left valve: *5a* lateral, *5b* anterior view; C.? waltersdorfensis Zone, Aksu-Dere section *II*

All figures in natural size



1 — *Inoceramus lusatiae* ANDERT, left valve; probably I. costellatus Zone, Selbuchra

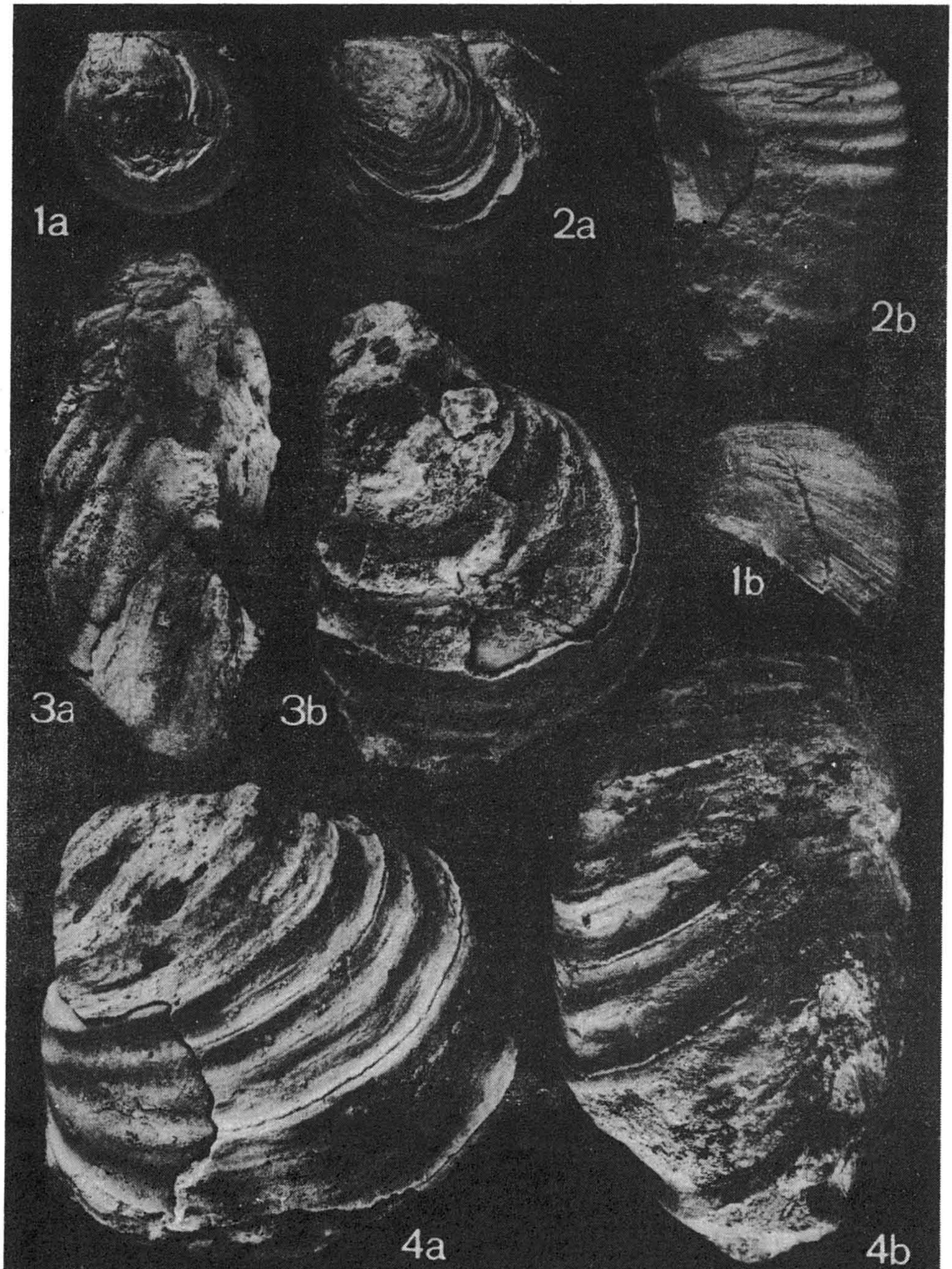
2 — *Cremnoceramus*? ex gr. *waltersdorfensis* (ANDERT), right valve; C.? waltersdorfensis Zone, Aksu-Dere section *II*

3 — *Inoceramus websteri* MANTELL, left valve; C.? waltersdorfensis Zone, Aksu-Dere section *II*

4-5 — *Inoceramus inaequivalvis* SCHLÜTER, left valve and double-valved specimen respectively, C.? waltersdorfensis and I. costellatus Zones respectively. Aksu-Dere section *II*

6 — *Inoceramus ernsti* HEINZ, right valve, leteral view; C. deformis Zone; temporary exposure north of Aksu-Dere

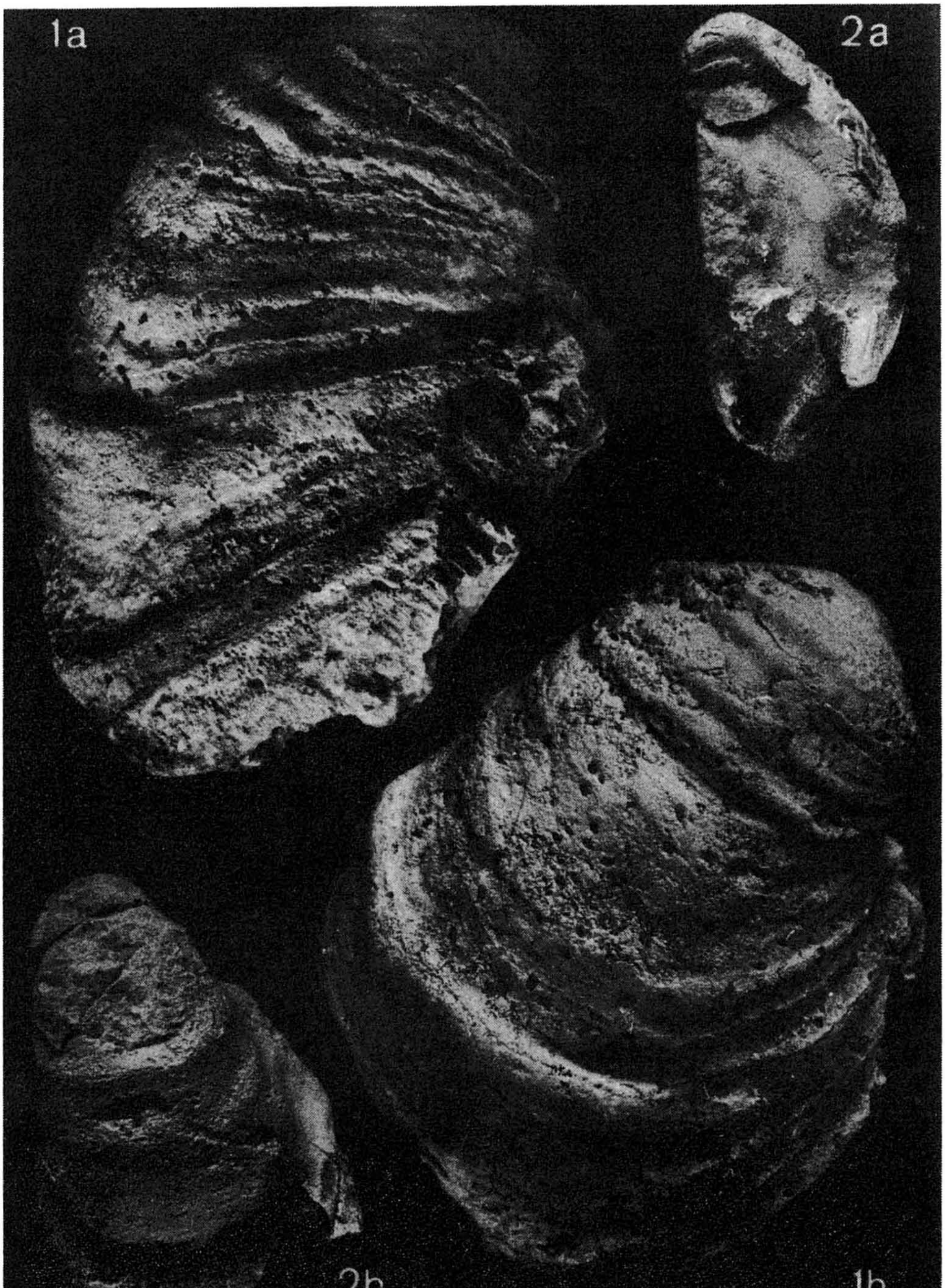
All figures in natural size



1-2 — *Cremnoceramus inconstans inconstans* (Woods), left valves: *a* lateral, *b* anterior view; C. deformis Zone, Aksu-Dere section *II*, × 1

3 — *Inoceramus* aff. *wandereri* Andert, right valve: *3a* lateral, *3b* anterior view; C. deformis Zone, temporary exposure north of Aksu-Dere, × 0.5

4 — *Cremnoceramus deformis* (Meek), left valve: *4a* lateral, *4b* posterior view; C. deformis Zone, temporary exposure north of Aksu-Dere, × 0.5



1 — *Inoceramus* cf. *macoweii* SZASZ, left valve: *1a* posterior, *1b* lateral view; C. deformis Zone, temporary exposure north of Aksu-Dere

2 — *Inoceramus inaequivalvis* SCHLÜTER, left valve: *1a* anterior, *2b* lateral view; C.? waltersdorfensis Zone, Aksu-Dere section *II*

Both figures in natural size