

Upper Eocene freshwater ostracods from Slovenia

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(with 1 figure and 4 plates)

In some Late Eocene sections of Slovenia rich freshwater ostracoda faunas were detected. Four species are new: *Kovalevskiella? creskovense* nov. sp., *Candona? creskovense* nov. sp., *Candona? krumbiegeli* nov. sp., *Herpetocyprilla? jeleni* nov. sp. From paleoecological point of view the most probable location is in a nearshore freshwater lake.

Geological introduction

A very interesting Eocene freshwater ostracod fauna from Slovenia, composed of Cytheridella was published by the author (MONOSTORI, 1993). From other localities (Vraček sections, Čreškova section) in north of Slovenia (Fig. 1.) very different communities were found (MONOSTORI, M. in JELEN, B. et al., 2001a). These coal bearing freshwater marls are below a marine sequence of Late Eocene age. The nannoplankton of the marine sequence in the Vraček section indicate zones NP 19-20 (and lowermost NP 21?), the nannoplankton of the marine sequence in Zavrh-2 profile indicate zones NP 19-20 (after M. BÁLDI-BEKE in: JELEN, B.; BÁLDI-BEKE, M.; CIMERMAN, F.; KEDVES, M.; MONOSTORI, M.; TOUMARKINE, M. ET ZÁGORŠEK, K. (2001a) and after M. BÁLDI-BEKE in: JELEN, B.; BÁLDI-BEKE, M.; CIMERMAN, F. ET TOUMARKINE, M. (2001b). The freshwater sediment consists of marls and siltstones (JELEN et al., 2001a). The ostracodes are exclusively carapaces infilled by pyrite or limonite, so the inner characters are not observable. Besides the ostracodes there are only plant remains and pollen in these beds. The ostracods of the Slovenian freshwater beds are the only evidence of a continental lake environment during the Late Eocene of this district.

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Systematical part

Subclass Ostracoda LATREILLE, 1806
Order Podocopida MÜLLER, 1894
Suborder Podocopina SARS, 1866
Superfamily Cytheracea BAIRD, 1850
Subfamily Limnocytherinae KLIE, 1938
Genus *Cytheridella* DADAY, 1905
Cytheridella buseri MONOSTORI, 1993
Plate 1., figs 1-2.

1993. *Cytheridella buseri* n. sp. – MONOSTORI, pp. 489-490, Pl. 1, f. 5, 8-11.

Remarks: The ornamentation is those of the specimens from the type locality. There are some valves more short and more inflated.

Dimensions: L = 0.83 – 0.88 mm
H = 0.49 – 0.59 mm
L/H = 1.49 – 1.77

Occurrence: Vračjek II section

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Čreškova – 1/93 section

(Konjiska Vas outcrop treated in MONOSTORI, 1993)

Material: 3 carapaces in the Vračjek-II section, eight carapaces and molts in the Čreškova-1/93 section, all material consist of mainly poorly preserved specimens.

Stratigraphical range: Konjiska Vas: Eocene; Vračjek, Čreškova: Late Eocene

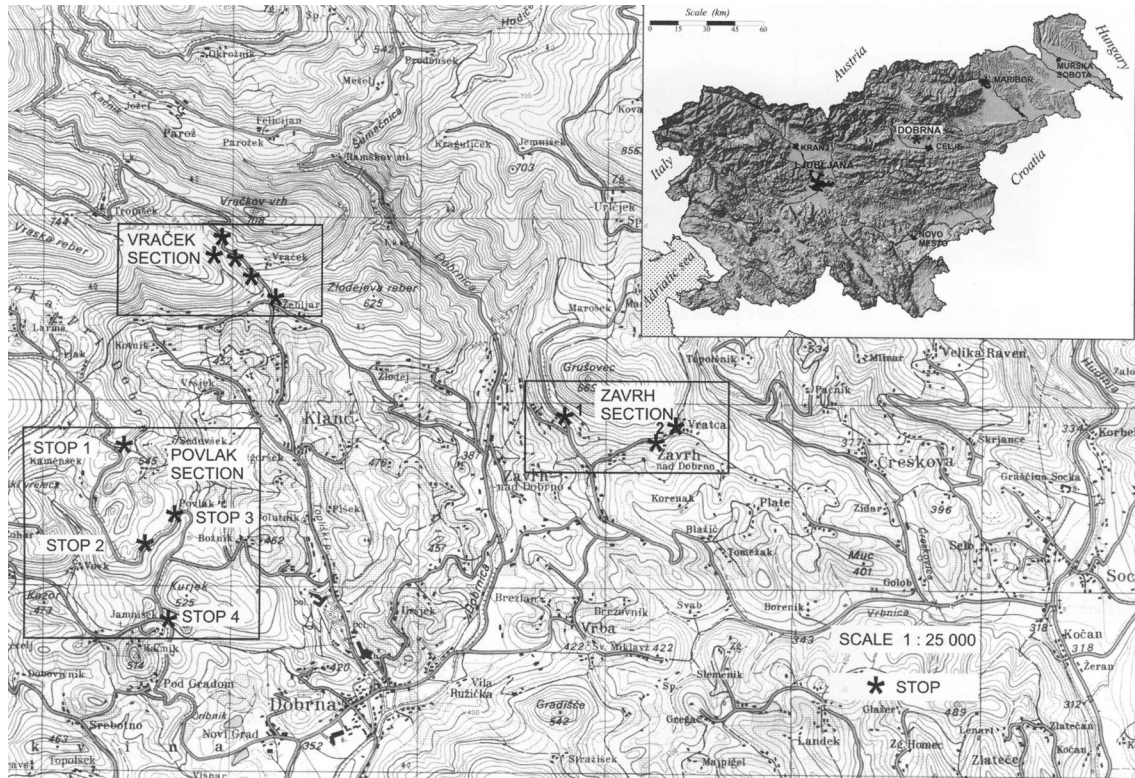


Fig. 1: Geographical map of the vicinity of Drobna with sections to be visited (JELEN et al. (2001c).

Subfamily Timiriaseviinae MANDELSTAM, 1947

Genus *Kovalevskiella* KLEIN, 1963

Kovalevskiella? *creskovense* nov. sp.

Plate 1, figs 3-10.

Derivatio nominis: after the locality name.

Holotypus: carapace, male. Pl. 1, fig. 6.

Paratypes: carapaces. Pl. 1, figs 3-5, 7-10.

Locus typicus: Čreškova-1 section; 4.5 – 5.1 m

Diagnosis: The outer surface is covered by large deep holes inside a sharp polygonal network.

Description: The anterior border is symmetrically rounded, its dorsal part has much longer radius. After a break at $\sim 1/3$ of length the dorsal outline is nearly straight, somewhat sinuous. The posterior border begins near the end of the length after a strong, nearly right-angled break, its dorsal part is nearly straight, the rounded ventral part turns into the straight or slightly rounded ventral outline. The left valve overlaps the right one throughout and there is a weak ear-like overlap at the postero-dorsal corner. In dorsal view of carapace the maximal width is at the $2/3$ length of the carapace (males) or at the $3/4$ length of the carapace (females). The females are much more inflated posteriorly (brood cavities). There is a sharp polygonal network on the surface with large deep holes within its meshes. The meshes of the network are large on the posterior part of the valves and, small on the anterior part.

Dimensions: L = 0.46 – 0.51 mm

H = 0.30 – 0.36 mm

L/H = 1.33 – 1.57

W = 0.34 – 0.38 mm

Comparison: this form obviously belongs to the Subfamily Timiriaseviinae. Strong ornamentation among the Tertiary and post-Tertiary genera characteristic for the *Kovalevskiella* KLEIN, 1963 (see in Klein, 1963, CARBONNEL et RITZKOWSKI, 1969; DANIELOPOL, 1971; VEKUA, 1975; COLIN et DANIELOPOL, 1980; CARBONNEL, 1985. CARBONNEL et al., 1986; BHANDARI, 1998) and *Frambocythere* COLIN, 1980 (see in COLIN et DANIELOPOL, 1980; DUCASSE et al., 1985; TAMBAREAU et al. 1991). The reticulation with deep holes within its meshes is rather different from the *Kovalevskiella* and *Frambocythere* but lack of the investigable inner characters does not allow to describe a new genus.

Occurrence: Slovenia, sections Vračjek-I, Vračjek-II, Čreškova-1/93.

Material: Vračjek-I section: 470 carapaces,
 Vračjek-II section: 400 carapaces,
 Čreškova-1/93 section: 6800 carapaces

Stratigraphical range: Late Eocene (Priabonian)

Superfamily Cypridacea BAIRD, 1845
 Family Candonidae Kaufmann, 1900
 Subfamily Candoninae KAUFMANN, 1900
 Genus *Candona* BAIRD, 1845
Candona? creskovense nov. sp.
 Plate 2, figs 1-8.

Derivatio nominis: After the locality name.

Holotypus: Carapace. Pl. 2, fig. 6.

Paratypes: Carapaces. Pl. 2, figs 1-5, 7-8.

Locus typicus: Čreškova -1/93 section; 3.7 – 4.4 m

Stratum typicum: Late Eocene (Priabonian)

Diagnosis: Moderately elongated candonid form with broadly rounded ends. The change of the height is insignificant from 1/3 to 2/3 of the length.

Description: The anterior border of the left valve is broadly and symmetrically rounded. The dorsal outline is very broadly and asymmetrically rounded, its median parts are sometimes nearly straight. The posterior end is broadly and more or less asymmetrically rounded. Its radius is similar or somewhat less than that of the anterior border. The ventral border is slightly concave.

On the right valve the dorsal border is trapezoidal, the concavity of the ventral border is deeper and more asymmetrical, the posterior border more asymmetrical. Maximal height is behind 1/3 of the length.

In dorsal view of the carapace maximal width is near the middle of the length. The posterior border is somewhat more broadly rounded compared with the anterior one. The surface of the valves is smooth. Inner features are not visible.

Dimensions: L = 0.48 – 0.65 mm

H = 0.29 – 0.36 mm

L/H = 1.78 – 2.00

W = 0.24 – 0.25 mm

Comparison: A similar form is known from the Eocene of Geiseltal described as *Candona* cf. *neglecta* SARS, 1888 by G. KRUMBIEGEL (1962b), but the more broadly rounded end at the Slovenian form is the anterior one. There is little variation in the asymmetry of the posterior, in the concavity of the ventral and in the form of the dorsal borders.

Occurrence: Vračjek-I section: 850 carapaces.

Vračjek-II section: about 12500 carapaces.

Čreškova-1/93 section: some 5500 carapaces.

Stratigraphical range: Late Eocene (Priabonian)

Candona? krumbiegeli nov. sp.
 Plate 2, figs 9-10.
 Plate 3, figs 1-2.

? 1962 *Candona* cf. *pratensis* HARTWIG, 1901 – KRUMBIEGEL, pp. 220-222, Pl. I, f. 1-3, Pl. II, f. 1-2, Pl. III, f. a-b.

Derivatio nominis: After the ostracodologist G. KRUMBIEGEL.

Holotypus: Carapace. Pl. 2, fig. 10.

Paratypes: Carapaces. Pl. 2, fig. 9, Pl. 3, figs 1-2.

Locus typicus: Čreškova-1 section, 3.7 – 4.4 m.

Stratum typicum: Late Eocene (Priabonian)

Diagnosis: Candonid form with nearly straight and anteriorly hardly convergent dorsal and ventral, nearly symmetrically rounded posterior, and asymmetrical anterior borders.

Description: The anterior border of the left valve is slightly asymmetrically rounded, the dorsal border is very broadly rounded from 0.3 to 0.7 of the length. It is nearly straight and nearly parallel with the ventral border. The posterior border broadly rounded, usually nearly symmetrical. The ventral outline is nearly straight. The anterior border of the right valve is significantly asymmetrical, the posterior one also more asymmetrical as that of the left valve. The ventral border is hardly concave. There is no ornamentation. The inner features are not visible.

Comparison: The outline is almost the same as those of the *Candona* cf. *pratensis* Hartwig in Krumbiegel, 1962. There is a little difference in the posterior/ventral break and in the more characteristic flattening of the anterior part on *C.* cf. *pratensis*.

Dimensions: L = 0.54 – 0.65 mm

H = 0.36 – 0.43 mm

L/H = 1.50 – 1.58

Occurrence: Vračjek-I, Vračjek-II and Čreškova-1/93 sections

Material: Vračjek-I section: 106 carapaces.

Vračjek-II section: 43 carapaces.

Čreškova-1/93 section: some hundred specimens.

Stratigraphical range: Late Eocene (Priabonian).

Candona ? sp. 1

Plate 3, fig. 3.

Remarks: A candonid form with very similar outline to *C. weltneri* HARTWIG, 1899 in KRUMBIEGEL, 1962b. There is only one incomplete carapace.

Occurrence: Vračjek-I section, 8.4 – 9.4 m.

Stratigraphical range: Late Eocene (Priabonian)

Family Cyprididae BAIRD, 1845
Subfamily Eucypridinae BRONSTEIN, 1947
Genus *Moenocypris* TRIEBEL, 1959
Moenocypris sp.
Plate 3, fig. 4.

Remarks: Rare carapaces resembling *M. sherborni* KEEN, 1972.

Dimensions: L = 1.02 – 0.59 mm.

H = 0.52 – 0.32 mm.

L/H = 1.84 – 1.98 mm.

Occurrence: Vračjek-I, Vračjek-II and Čreškova-1/93 sections.

Material: Vračjek-I section: 15 carapaces.

Vračjek-II section: 6 carapaces.

Čreškova-1/93 section: 20-30 poorly preserved carapaces.

Stratigraphical range: Late Eocene (Priabonian).

Subfamily Herpetocypridinae BRONSTEIN, 1947
Genus *Herpetocyprilla* DADAY, 1909
Herpetocyprilla? *jeleni* nov. sp.
Plate 3, figs 5.,
Plate 4, figs 1-8.

Derivatio nominis: After the Slovenian geologist B. JELEN.

Holotypus: Carapace. Pl. 3, fig. 5.

Paratypes: Carapaces. Pl. 3, figs 6-10, Pl. 4, figs 1-8.

Locus typicus: Čreškova 1/93 section; 3.0 – 3.7 m.

Stratum typicum: Late Eocene (Priabonian)

Diagnosis: Trapezoidal form with posteriorly decreasing height. There is a prominent overlap (LV>RV) at the

cardinal angle. Characteristic is the sharp node in the middle of the valves.

Description: The shape is rather variable. The anterior border of the left valve is asymmetrical, its lower part broadly rounded, the upper part is more or less straight. There is a conspicuous break at about 0.3 of length. The dorsal border is straight, the posterior one is asymmetrically rounded in different degree. (There are specimens slowly sloping backwards with only slightly asymmetrical, blunt posterior end and other specimens rapidly sloping backwards with very asymmetrical posterior end having small radius.) The ventral border is asymmetrically concave or nearly straight.

The right valve has a conspicuous depression on the dorsal part of the anterior border, so there is a strong overlap of left valve on the right one near the cardinal angle. The ventral border is more concave than those of the left valve.

In dorsal view the borders are broadly and symmetrically rounded, maximum width is in the middle. The ends are obtuse. The surface is smooth with a prominent node of spine in the middle of both valves. They are frequently pointed and somewhat backward directed. Inner features are not visible.

Comparison: This genus is described from China, Kirgizia and Turkmenia (Pliocene to Recent) (DADAY, 1909; MANDELSTAM et SCHNEIDER, 1963; HUANG Bao-ren, 1982). Similar forms were discovered by F. M. SWAIN from the Cenozoic beds of the USA: *Pactolocypris* SWAIN, 1985 (also *Herpetocyprinae* according to SWAIN (1999) and *Tuberocypris* SWAIN, 1947 *Candoninae* according to SWAIN (1999).

Dimensions: L = 0.59 – 0.65 mm.
H = 0.33 – 0.41 mm.
L/H = 1.59 – 1.82 mm.
W = 0.31 – 0.33 mm

Occurrence: Vračjek-I, Vračjek-II and Čreškova-1 sections.

Material: Vračjek-I section: 166 carapaces and thousands of fragments.

Vračjek-II section: about 914 carapaces.

Čreškova-1/93 section: about 186 carapaces.

Stratigraphical range: Late Eocene (Priabonian)

(All the materials are deposited in the Paleontological collection of the Palaeontological Department, Eötvös University.)

Paleoecological evaluation

Quantitative analysis of the fauna has demonstrated the insignificant occurrence of *Cytheridella busheri* in the investigated material in contrast to Konjska Vas material (MONOSTORI, 1993) consisting of only specimens of this species.

In the Čreškova-1/93 section *Moenocypris?* sp. is rare form, *Candona? krumbiegeli* is an evenly frequent, but never predominant form, *Herpetocyprilla? jeleni* is sometimes rare, sometimes more frequent form without any dominant role. The main character of the fauna is determined by two species: *Kovalevskiella? creskovense* and *Candona? creskovense*. Their predominance is alternating: in samples 3.7 – 4.4 m and 4.4 – 5.1 m predominates the *Kovalevskiella? creskovense*, in samples 3.1 – 3.7 m and 15.0 m the main component is the *Candona? creskovense* and in the samples 2.45 – 2.85 m and 9.0 m they are equally frequent.

In the Vračjek-I and Vračjek-II sections the predominant species are the same ones: *Kovalevskiella? creskovense* and *Candona? creskovense* with, an irregular alternation. In some samples (13.1 – 14.2 m sample of Vračjek-I section and 1. sample of Vračjek-II section) the *Herpetocyprilla? jeleni* is very frequent, in the first case the fragments are highly predominant, in the second case the complete carapaces are extremely frequent (with a lot of *Candona? creskovense*). The other species are rare or moderately frequent forms in these sections.

Some remarks about the ecology of the detected forms: *Cytheridella* is a typical freshwater form living in shallow waters characterized by plenty of vegetal debris (PURPER, 1974). *Kovalevskiella* is a freshwater interstitial form, but similarly to Aquitanian forms (CARBONEL et al., 1986) the form occurred in Slovenia sampled from fine grained sediments. They were living also in epibios (as supposed by CARBONEL et al (1986) for the Aquitanian material). This fact is emphasized by the preservation (carapaces infilled by pyrite).

The genus *Candona* has very diverse ecological adaptations.

Herpetocyprilla and the named *Pactolocypris* and *Tuberocypris* are limnic forms (DADAY, 1909; HUANG Bao-ren, 1982; MANDELSTAM et SCHNEIDER, 1963; SWAIN F. M., 1999; VEKUA, M. L. 1975). From

ecological point of view the genera or their close relatives are freshwater forms, but several forms e. g. *Candona* are well known from nearshore lakes with very low salinity and also from inland seas of very low salinity. The most probable location is in a nearshore freshwater lake after the coal swamp (detected by coal bearing beds) which turn later to shallow marine lagoon during the marine transgression. This transgression is investigable by ostracods in the Vračjek section up to the deep, bathyal marine environments (MONOSTORI, 2004, in press).

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Plate 1

Figs 1-2. *Cytheridella buseri* MONOSTORI, 1993

Fig. 1. 42x. Čreškova-1/93 section, 3.7 – 4.4 m. Carapace from the right valve

Fig. 2. 60x. Čreškova-1/93 section, 9.0 m. Carapace from the left valve.

Figs 3-10. *Kovalevskiella? cresskovense* n. sp.

Fig. 3. 95x. Čreškova-1/93 section, 3.0 – 3.7 m. Carapace from the right valve.

Fig. 4. 78x. Čreškova-1/93 section, 3.0 – 3.7 m. Carapace (female) from the dorsal side.

Fig. 5. 85x. Čreškova-1/93 section, 3.0 – 3.7 m. Carapace from the right valve.

Fig. 6. 95x. Čreškova-1/93 section, 4.4 – 5.1 m. Carapace from the right valve. Holotype.

Fig. 7. 95x. Čreškova-1/93 section, 4.4 – 5.1 m. Carapace (male) from the dorsal side.

Fig. 8. 95x. Čreškova-1/93 section, 4.4 – 5.1 m. Carapace from the right valve.

Fig. 9. 100x. Čreškova-1/93 section, 9.0 m. Carapace from the ventral side.

Fig. 10. 95x. Čreškova-1/93 section, 9.0 m. Carapace from the left valve.

(All the materials are deposited in the Paleontological Collection of the Palaeontological Department, Eötvös University, Budapest)

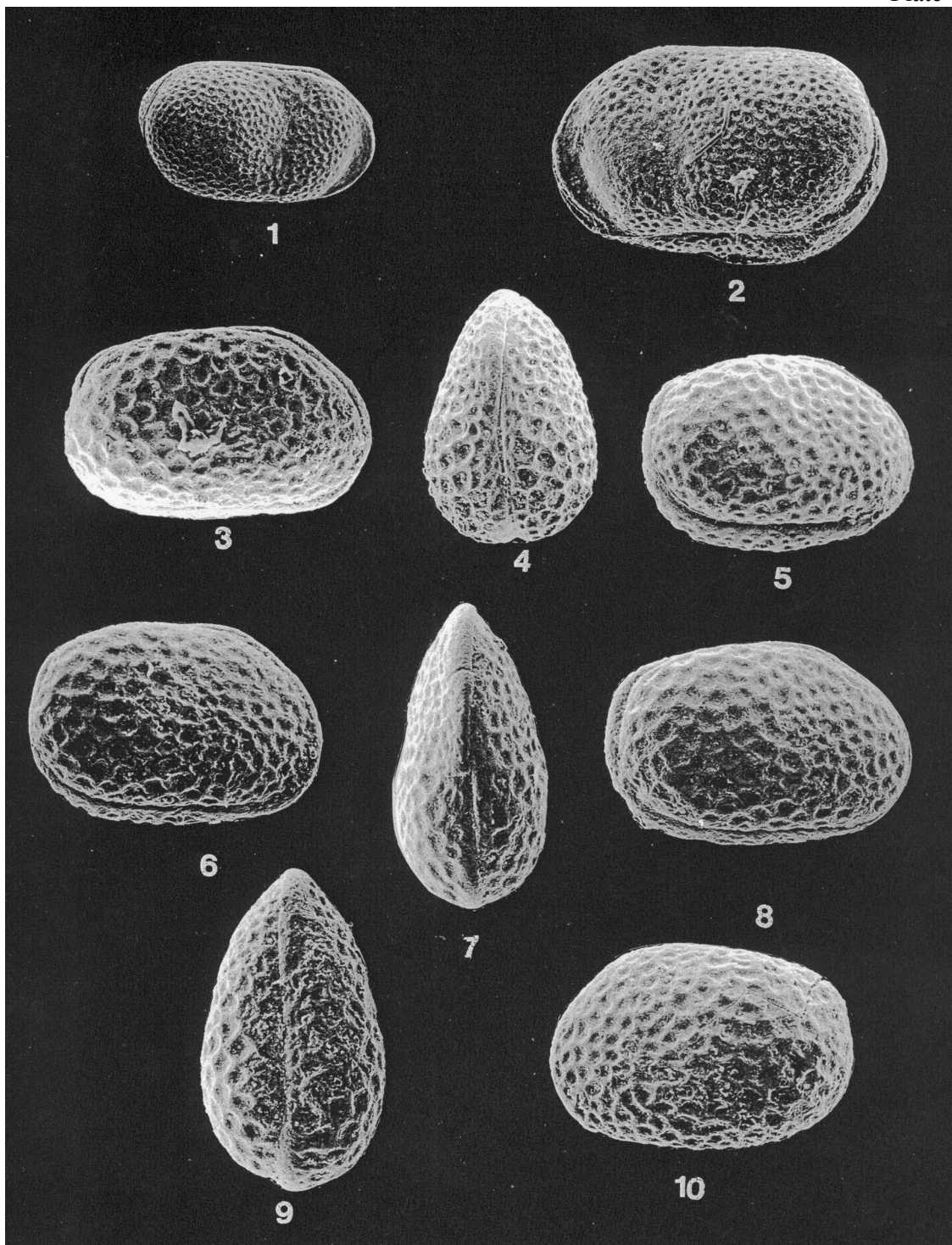


Plate 2

Figs 1-8. *Candona? creskovense* n. sp.

- Fig. 1. 73x. Čreškova-1/93 section, 3.0 – 3.7 m. Carapace from the right valve.
- Fig. 2. 73x. Čreškova-1/93 section, 3.0 – 3.7 m. Carapace from the right valve.
- Fig. 3. 75x. Čreškova-1/93 section, 3.7 – 4.4 m. Carapace from the right valve.
- Fig. 4. 85x. Čreškova-1/93 section, 3.7 – 4.4 m. carapace from the dorsal side.
- Fig. 5. 80x. Čreškova-1/93 section, 3.7 – 4.4 m. Carapace from the right valve.
- Fig. 6. 80x. Čreškova-1/93 section, 3.7 – 4.4 m. Carapace from the right valve. Holotype.
- Fig. 7. 75x, Čreškova-1/93 section, 9.0 m. Carapace from the right valve.
- Fig. 8. 75x. Čreškova-1/93 section, 9.0 m. Carapace from the right valve.

Figs 9-10. *Candona? krumbiegeli* n. sp.

- Fig. 9. 82x. Čreškova-1/93 section, 3.0 – 3.7 m. Carapace from the left valve.
- Fig. 10. 72x. Čreškova-1/93 section, 3.7 – 4.4 m. Carapace from the left valve. Holotype.

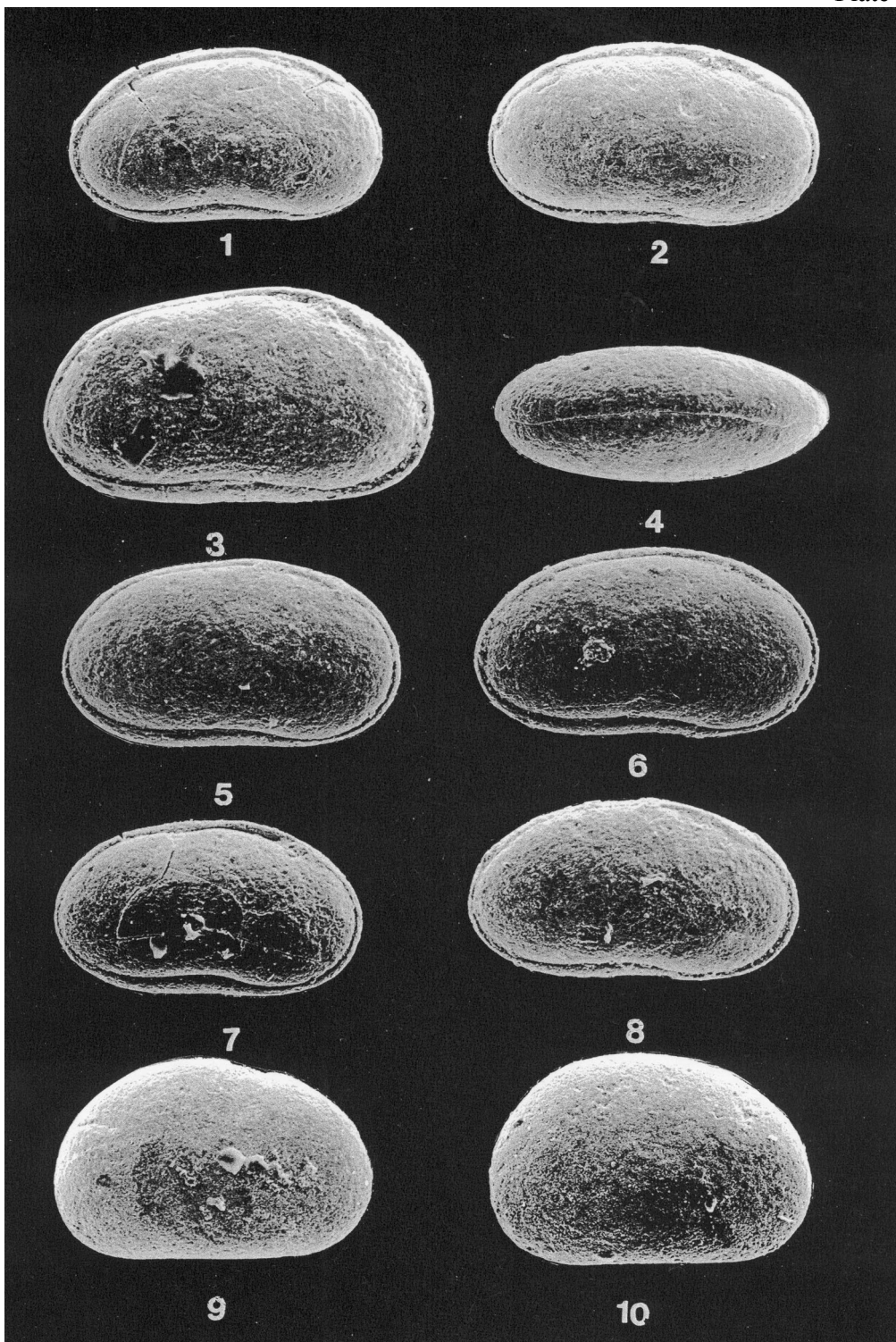


Plate 3

Figs 1-2. *Candona? krumbiegeli* n. sp.

Fig. 1. 72x Čreškova-1/93 section, 9.0 m. Carapace from the right valve.

Fig. 2. 105x. Vračjek-I section, sample 1. Carapace from the right valve.

Fig. 3. *Candona? sp.* 1.

125x. Vračjek-I section, 8.4 – 9.4 m. Carapace from the right valve.

Fig. 4. *Moenocypris sp.*

72x. Čreškova-1/93 section, 3.7 – 4.4 m. Carapace from the left valve.

Figs 5-10. *Herpetocyprella? jeleni* n. sp.

Fig. 5. 80x. Čreškova-1/93 section, 3.0 – 3.7 m. Carapace from the right valve. Holotype.

Fig. 6. 75x. Čreškova-1/93 section, 3.7 – 4.4 m. Carapace from the dorsal side.

Fig. 7. 85x. Čreškova-1/93 section, 3.7 – 4.4 m. Carapace from the right valve.

Fig. 8. 82x. Čreškova-1/93 section, 3.7 – 4.4 m. Carapace from the dorsal side.

Fig. 9. 80x. Čreškova-1/93 section, 4.4 – 5.1 m. Carapace from the right valve.

Fig. 10. 90x. Čreškova-1/93 section, 4.4 – 5.1 m. Carapace from the dorsal side.

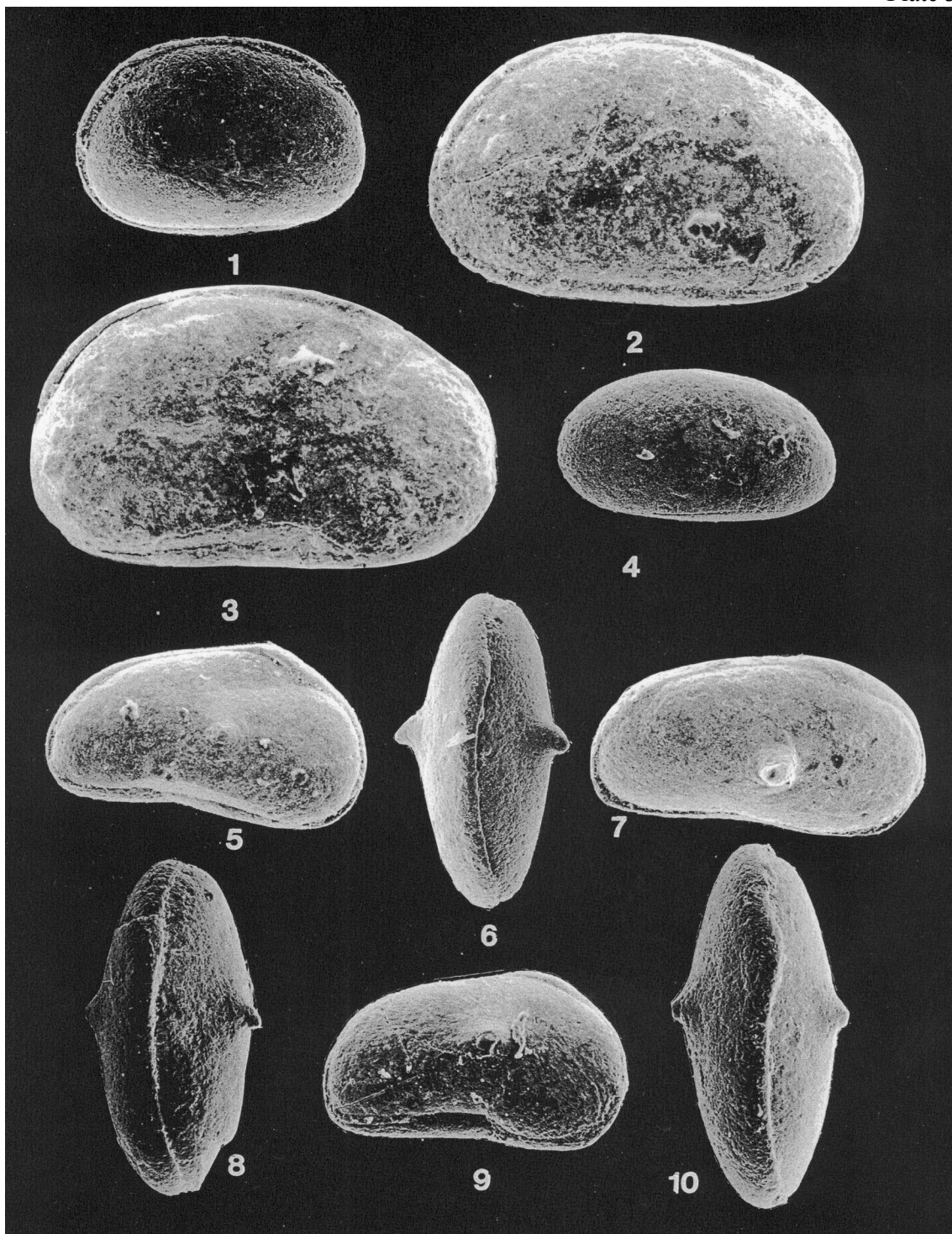


Plate 4

Figs 1-8. *Herpetocyprilla? jeleni* n. sp.

- Fig. 1. 82x. Čreškova-1/93 section, 9.0 m. Carapace from the right valve.
- Fig. 2. 73x. Čreškova-1/93 section, 9.0 m. Carapace from the right valve.
- Fig. 3. 80x. Čreškova-1/93 section, 9.0 m. Carapace from the right valve.
- Fig. 4. 82x. Čreškova-1/93 section, 9.0 m. Carapace from the right valve.
- Fig. 5. 80x. Vračjek-I section, 8.2 – 9.2 m. Carapace from the left valve.
- Fig. 6. 105x. Vračjek-II section, sample 1. Carapace from the left valve.
- Fig. 7. 75x. Vračjek-I section, 13.2 – 14.2 m. Carapace from the left valve.
- Fig. 8. 120x. Vračjek-II section, sample 1. Carapace from the right valve.

