

Fig. 1. Bathonian / Callovian Correlation Chart of Subboreal Europe and E. Greenland
(D.B. Gulyaev, 2015 - under construction)

North-West and Central Europe (By Page, 1988: PhD thes., 1996; Callomon et al., 1988, 1989, 1992; Dietl, 1994; Mönnig, 1995, 2014, in epist.; Cox, Sumer, 2002; Dietze et al., 2007, etc.)		European Russia and Central Ukraine (Own researches and revision of materials of other researchers)	East Greenland (By Callomon, 1993, 2004, etc. and own revision of Callomon's collection, e.g. Gulyaev, 2011, 2012, 2015 in press)	
ZONES		ZONES	ZONES	
England		Germany		
Biohorizon's index-species (bold) and most important macroconch species		Biohorizon's index-species (bold) and others macroconch species	Biohorizon's index-species (bold) and others macroconch species	
CALLOVIAN	KOENIGI (part.)			
	<i>K. (G.) gowerianus</i> , <i>M. cf. aff. macrocephalus</i> , <i>C. ex gr. tolype</i> , <i>Pr. koenigi</i>			
	<i>K. (G.) metorchus</i> , <i>M. lophopleurus</i> , <i>Ch. chamousseti</i> , <i>C. ex gr. tolype</i> , <i>Pr. koenigi</i>	<i>K. (G.) metorchus</i> , <i>M. megaliocephalus</i> , <i>Pr. koenigi</i>	<i>K. (G.) gowerianus</i> , <i>Ch. chamousseti</i> , <i>Pr. koenigi</i>	<i>K. (G.) gr. metorchus-gowerianus</i> , <i>C. ex gr. tolype</i> , <i>Ch. chamousseti</i> , <i>Proplanulites sp.</i>
	? <i>K. toricellii</i>	<i>K. (G.) toricellii</i>	<i>Ch. saratovensis</i> ⁽³⁴⁾ , <i>K. (G.) toricellii</i> , <i>Parachoffatia/Proplanulites sp.</i> (transient)	
	<i>M. kamptus</i> 'γ' / <i>M. polyptychus</i>		<i>C-ch. uzhovkensis</i> ⁽³³⁾ , <i>K. (G.) gr. russiensis-toricellii</i> (or <i>K. (G.) hildesheimensis</i> ⁽³²⁾), <i>Parachoffatia sp.</i>	
	<i>M. kamptus</i> 'β'	N.Germany: <i>M. cf. kamptus</i> S.G.: <i>K.(G.) hildesheimensis</i> ?	<i>C-ch. subpatruus</i> , <i>K. (G.) russiensis</i> (or <i>K. (G.) hildesheimensis</i> ⁽³²⁾), <i>Parachoffatia sp.</i>	? <i>C. septentrionale</i> sensu Callomon
	<i>M. kamptus</i> 'α' / <i>M. herveyi</i>		<i>C-ch. surensis</i> , <i>Cadoceras sp. ind.</i> , <i>M. pavlowi</i> ⁽²⁷⁾ , <i>K. (G.) russiensis</i> , <i>Parachoffatia sp.</i>	
	<i>M. terebratus</i> 'γ'		<i>C-ch. tschernyschewi</i> ⁽³¹⁾ , <i>C. aff. quenstedti</i> ⁽³⁰⁾ , <i>M. pavlowi</i> ⁽²⁷⁾ , <i>K. (G.) russiensis</i> , <i>Parachoffatia sp.</i>	
	<i>M. terebratus</i> 'β'	<i>M. cf. terebratus</i>	<i>P. (Ross.) vasily n. provis</i> ⁽²⁹⁾ , <i>C. aff. quenstedti</i> ⁽²⁸⁾ , <i>M. pavlowi</i> ⁽²⁷⁾ , <i>K. (G.) russiensis</i> ⁽²⁶⁾ , <i>Parachoffatia sp.</i> , <i>Choffatia sp.</i>	<i>P. (Opist.) nordenskjoldi</i> 'β', ? <i>K. (K.)</i> "aff. traillensis"
	<i>M. terebratus</i> 'α', <i>P. breve</i>	<i>P. (Ross.) suevicum</i> 'α, β' [= <i>elatmae</i> s.l.] <i>M. verus</i> , N.Gemmany only: <i>M. multicostatus</i> [=menzel]	<i>P. (Ross.) elatmae</i> ⁽²⁵⁾ , <i>C. quenstedti simulans</i> ⁽²⁴⁾ , <i>M. multicostatus</i> ⁽²³⁾ , <i>M. verus</i> ⁽²²⁾ , <i>M. terebratus</i> ⁽²¹⁾ , <i>M. volgensis</i> ⁽²⁰⁾ , <i>B. (Ker.) bullatus</i> ⁽¹⁹⁾	<i>P. (Opist.) nordenskjoldi</i> 'α' [?= <i>catastoma</i> sensu Imlay (part.)] ? <i>K. (K.)</i> "aff. traillensis"
	<i>M. verus</i>		<i>P. (Ross.) chvadukasyense</i> nom. provis. ⁽¹⁸⁾ , <i>C. quenstedti quenstedti</i> ⁽¹⁷⁾ , <i>M. cf. aff. jacquoti</i> ⁽¹⁶⁾ (transient)	<i>P. (Opist.) breve</i> , <i>C. aff. apertum</i> (cf. <i>simulans</i>), <i>K. (K.)</i> "aff. traillensis", <i>M. multicostatus</i>
		<i>C. quenstedti</i> (typical), <i>M. jacquoti</i> (typical)		<i>K. (K.) tenuifasciculatus</i>
			<i>P. (Ross.) primaevum</i> ⁽¹⁵⁾ , <i>C. quenstedti sub.sp.1</i> ⁽¹⁴⁾ , [?= <i>C. apertum</i> 'γ'] <i>M. jacquoti</i> ⁽¹³⁾	<i>C. apertum</i> 'γ' [?= <i>quenstedti</i>] <i>P. (Opist.) cf. aff. catastoma</i> sensu Imlay (part.) ? <i>K. (K.) gr. keppleri-traillensis</i>
		<i>K. (K.) keppleri</i> , <i>M. jacquoti</i>	<i>P. (Ross.) poultoni</i> ⁽¹²⁾ , <i>M. jacquoti</i> ⁽¹¹⁾ , <i>K. (K.) ex gr. keppleri</i> ⁽¹⁰⁾	<i>C. apertum</i> 'β', <i>P. (?Ross.) cf. aff. poultoni</i> , <i>K. (K.) gr. keppleri-traillensis</i>
BATHONIAN	DISCUS			
	<i>Parachoffatia arisphinctoides</i>	<i>K.(K.) radiatus</i> sensu Mönnig, <i>M. jacquoti</i> ?	<i>C. apertum</i> (sensu Mitta) ⁽⁹⁾ , <i>K. (K.) ex gr. keppleri</i> ⁽⁸⁾	
	<i>Cl. hochstetteri</i>	<i>Cl. hochstetteri</i> , <i>M. jacquoti</i> (early)	<i>P. (Cat.) sakharovi</i> ⁽⁷⁾ , <i>K. (K.) ex gr. keppleri</i> ⁽⁶⁾	
	<i>Cl. discus</i>	<i>Cl. discus</i>		
	<i>Cl. hollandi</i>	<i>Cl. cf. hollandi</i>		
	ORBIS			
<i>Cl. cf. schippeii</i>	<i>K. (K.) dietli</i> ? <i>K. (K.)</i> "aff. aigii" <i>K. (K.)</i> "cf. aff. peramplius"	<i>P. (Cat.) infimum</i> ⁽⁵⁾ , <i>C. calyx</i> ⁽⁴⁾ , <i>K. (K.) svalbardensis</i> ⁽³⁾	<i>K. (K.) vardekloeftensis</i> , <i>C. calyx</i>	
? <i>Homoeoplanulites sp.</i>			<i>K. (K.) svalbardensis</i> (large forms described as <i>K. (K.) peramplius</i>), <i>P. (Cat.) infimum</i> , <i>C. cf. calyx</i>	
<i>Procerites twinhoensis</i>	<i>Hemigarantia julii</i>	<i>P. (Cat.) barnstoni</i> ⁽²⁾ , <i>K. (K.) rozenkrantzi</i> ⁽¹⁾	"mixture of two faunas" (Callomon, 1993, p. 102) <i>K. (K.) rozenkrantzi</i> s.l., <i>P. (Cat.) barnstoni</i> s.l., <i>P. (Cat.) variabile</i> 'β', <i>C. cf. aff. calyx</i>	
		not normal marine sediments		

Abbreviations: *B.* - *Bullatimophites*, *C.* - *Cadoceras*, *Cat.* - *Catacadoceras* (subgen.), *C-ch.* - *Cadochamousssetia*, *Ch.* - *Chamousssetia*, *Cl.* - *Clidoniceras*, *G.* - *Gowericeras* (subgen.), *K.* - *Kepplerites*, *M.* - *Macrocephalites*, *Opist.* - *Opisthocadoceras* nom. provis. (subgen.), *Pr.* - *Proplanulites*, *Ross.* - *Rossicadoceras* nom. provis. (subgen.)

Notes on the East European scale:

- (1) E.g. *K.(K.)* ex gr. *rosenkrantzi* Spath (part.) in Kiselev, Rogov, 2007b, pl. 2. fig. 1-3 (only).
- (2) Incl. *P. nageli* Mitta and *P. efimovi* Mitta (inflated morphotype) in Mitta, 2005.
- (3) Incl. all (!) figured *Kepplerites* in Gulyaev, Kiselev, 1999a, b; *K.(K.) svalbardensis* Sok. et Bodyl. in Mitta, 2000, pl. 59; all (!) figured *K.(K.) keppleri* (Opp.) in Mitta, Starodubtseva, 2000; *K. aff. peramplus* Spath in Mitta, 2004, pl. II, fig. 1, 2; *K. traillensis* Donovan in Mitta, 2004, pl. III (same locality and level as *K.(K.) svalbardensis* in Mitta, 2000); *K.(K.) rosenkrantzi* Spath (inflated coarsely ribbed morphotype) in Kiselev, Rogov, 2007a, pl. I, fig. 4, pl. 2, fig. 1; all or most of figured *Kepplerites* in Mitta, 2008; ? *K.(K.)* cf. *vardekloeftensis* Call. in Kiselev, Rogov, 2007b, pl. 5, fig. 4, 5. NB – *K.(K.)* cf./aff. *peramplus* Spath (Dietl, Callomon, 1988) and some *K.(K.) dietli* Schairer (1990) from Orbis-Oolith strongly resembles *K.(K.) svalbardensis* Sok. et Bodyl. It seems that typical Greenland *K.(K.) peramplus* is just large morphotype of *K.(K.) svalbardensis*.
- (4) E.g. *C. calyx* Spath in Mitta, 2005, pl. 8, fig. 1. Seems non *C.(B.) calyx* Spath in Kiselev, Rogov, 2007, fig. 1, 2 [= *P.(C.) infimum* Gul. et Kis. - inflated morphotype].
- (5) Incl. *C. bodylevskiyi* Frebold in Mitta, 2000, pl. 9; *C. nordenskjoldi* Call. et Birk. in Mitta, 2004, pl. IV, fig. 1 (same locality and level as the previous); *P. keuppi* Mitta, 2005 (“depressed” morphotype); *Paracadoceras* sp. in Mitta, 2005, pl. 7, fig. 5; ? *C.(B.) calyx* Spath (inflated morphotype) in Kiselev, Rogov, 2007, fig. 1. See also *P.(C.) infimum* in Gulyaev, 2009, fig. 2; 2012, fig. 1.
- (6) E.g. *K.(K.) keppleri* (Opp.) in Mitta, 2000, pl. 60, fig. 1-3; *K.(K.)* sp. juv. (ex gr. *keppleri*) in Gulyaev, 2007, pl. I, fig. 1; *K.(K.)* ex gr. *keppleri* (Opp.) in Kiselev, Rogov, 2007a, pl. I, fig. 5, 6.
- (7) It is the same as “*C. cf./aff. infimum*” (Gulyaev, 2001), “*P. infimum* subsp. nov.” (Gulyaev et al., 2002; Gulyaev, 2005, 2007) and “*P.(C.) cf./aff. ammon*” (Gulyaev, 2009, fig. 2 (collage), 2011). E.g. *C. frearsi* (Orb.) part. (extremely finely ribbed morphotype) in Mitta, 2000, pl. 12, fig. 1 (only); *C.(P.)* cf. *bodylevskiyi* Freb. in Kiselev, Rogov, 2007a, pl. IV, fig. 1, 2; *C.(P.) bodylevskiyi* & aff. *bodylevskiyi* in Kiselev, Rogov, 2007b, pl. 3, fig. 1-5.
- (8) Very rare unpublished fragments from “Staroe” (Mordovia), similar to *K.(K.) radiatus* Lom. et. Sakh. sensu Mönnig, in epist.
- (9) E.g. *C. apertum* Call. et. Birk. in Mitta, 2005, pl. 7, fig. 1-3; *C. ex gr. apertum* in Kiselev, Rogov, 2007, pl. 5, fig. 1-3.
- (10) Very rare poorly preserved remains.
- (11) E.g. *M. jacquoti* (Douv.) in Gulyaev, 2001, pl. I, fig. 1; Kiselev, Rogov, 2007, pl. II, 3-6; Gulyaev, Rogov, 2009, fig. 2.
- (12) *P. poultoni* Gulyaev, 2005 is nom. nov. pro *Cadoceras bodylevskiyi* Frebold sensu Poulton, 1987, holotype – l.c., pl. 27, fig. 4-6 (Gulyaev, 2005, p. 65). E.g. *P. poultoni* Gul. in Gulyaev, 2007, pl. I, fig. 2-5, pl. IV, fig. 5 (Pizhma, Pechora region); *C.(C.) cf. nordenskjoldi* Call. et Birk. in Kiselev, Rogov, 2007a, pl. IV, fig. 5; *C.(P.)* cf. *breve* Blake in l.c., pl. IV, fig. 6; Kiselev, Rogov, 2007b, pl. 4, fig. 1-3 (Middle Volga region).
- (13) E.g. *M. jacquoti* (Douv.) in Gulyaev, 2001, pl. I, fig. 2; 2007, pl. IV, fig. 2.
- (14) E.g. *C. quenstedti falsum* Vor. in Gulyaev, 2007, pl. III, fig. 1-3.
- (15) Incl. *C. frearsi* (Orb.) sensu Nikitin, 1885 and Callomon, 1985. The type of *Amm. Freasi* d’Orbigny, 1845 is now lost (at least it is missing in the Verneuil’s collection). Initially it seemed that this specimen comes from the Middle/Upper Callovian (see Nikitin, 1878). [Later Nikitin (1885) has changed the opinion and has described under the name “*frearsi* Orb.” the ammonite from the Lower Callovian of Elatma. In 1888 Nikitin saw this ammonite during his visit to Paris; he wrote that its preservation is similar to in the Lower Callovian of Elatma (Nikitin, 1889, p. 377).] On ribbing ratio and umbilical funnel relative width (measured on Orbigny’s figure) this ammonite is close to the latest *Cadoceras* s.str. (such as *C. vetulum* Kiselev, *C. rybinskianum* (Nikitin), etc.). On high ribbing ratio and quasi-triangular whorl section it also can belong to *Cadochamoussetia surensis* (Nik.). But because of all these features original of *Amm. Freasi* d’Orb. cannot belong to lowermost Lower Callovian *Paracadoceras* (as “neotype” designated by Callomon) in any way. So the action of J. Callomon (1985) on a designation of neotype of *C. frearsi* (Orb.) sensu Nikitin, 1885 seem void (according to ICZN, art. 75 in such cases plenary power of the Commission are required). *Amm. Freasi* d’Orbigny, 1845 while should be considered as nomen dubium. The oldest available name for *C. frearsi* sensu Nikitin, 1885 is *C. primaevum* Sasonov, 1957 (Gulyaev, 2005, etc.).
- (16) E.g. *M. cf./aff. jacquoti* (Douv.) in Gulyaev, 2007, pl. IV, fig. 3.
- (17) E.g. *C. falsum* Vor. in Meledina, 1994, pl., X, fig., 3, pl. XI, fig. 1; *C. tschernyschewi* Sok. in l.c., pl. XV, fig. 2 (Pizhma, Pechora region); all figured *C. falsum* Vor. in Mitta, 2000 (Middle Volga region); *C.*

quenstedti quenstedti Spath in Gulyaev, 2007, pl. III, fig. 4, pl. IV, fig. 1 (Pizhma, Pechora region). NB - Siberian *C. falsum* Vor. is difficult for interpretation, it may be a synonym or early chrono-subspecies of *C. quenstedti* Spath (see note 14) or an intermediate form between *C. calyx* Spath and *C. quenstedti* Spath.

- (18) To be published. It is the same as “*P. elatmae anabarensis*” in Gulyaev et al., 2002; Gulyaev, 2005. E.g. *C. elatmae* Nik. (pars) in Mitta, 2000, pl. 16, fig. 2-left (only); *P. sp. nov.* (aff. *elatmae*) in Gulyaev, 2007, pl. II, fig. 3; 2009, fig. 2.
- (19) Found only in Kanev (Ukraine). Will be published soon (Gulyaev, 2015b-in press).
- (20) E.g. *M. volgae* Gul. in Gulyaev, 2001, pl. VI, fig. 1.
- (21) E.g. *M. cf. terebratus* (Phill.) in Kiselev, Rogov, 2007a, pl. V, fig. 1.
- (22) E.g. *M. verus* Buckm. in Kiselev, Rogov, 2007a, pl. V, fig. 3.
- (23) Originally described as *Chamoussetia multicostata* Paryshev, 1977 from Lower Callovian of Kanev (Ukraine). Incl. *Chamoussetia menzeli* Mönning, 1995; *Macrocephalites prosekensis* Gulyaev, 2001, etc. E.g. *Eckhardites pavlowi* (Smor.) (part.) in Mitta, 2000, pl. 4, fig. 4, pl. 6, fig. 3, pl. 7, fig. 3, pl. 8, fig. 3; ? *E. aff. menzeli* in l.c., pl. 7, fig. 4; *M. prosekensis* in Kiselev, Rogov, 2007a, pl. V, fig. 2; *E. menzeli* (microconch) in Mitta, 2009, pl. 6, fig. 9; etc. Revision will soon be published (Gulyaev, 2015a-in press).
- (24) E.g. *C. simulans* Spath (part.) in Mitta, 2000, pl. 19, fig. 1 (only) (holotype, refigured original of “*C. modiolare*” in Nikitin, 1885).
- (25) Incl. *C. suevicum* Callomon et Dietl, 1989 (small-“depressed” morphotype); *C. pishmae* Meledina, 1994 (large morphotype); *C. tschernyschewi* Sok. sensu Mitta (part.) (e.g. Mitta, 2000, pl. 21, fig. 2, pl. 22, fig. 3, 4).
- (26) Rare poorly preserved material from Kanev district.
- (27) Differs from *M. multicostatus* by earlier ribbing reduction and ventral sharpening in young whorls. Incl. *Eckhardites dietli* Mitta, 2009. E.g. *M. pavlowi* Smor. in Gulyaev, 1999, pl. 1, fig. 2, pl. 2, fig. 1, pl. 3, fig. 3; etc.
- (28) E.g. *C. tschernyschewi* Sok. in Mitta, 2000, pl. 20, fig. 2.
- (29) To be published. It is the same as “*P. sp. nov.* (aff. *elatmae*)” in Gulyaev, Ippolitov, 2013; Gulyaev et al., 2014. E.g. *C. tschernyschewi* Sok. in Mitta, 2000, pl. 21, fig. 1.
- (30) It is similar to *Cadoceras* from the previous Biohorizon.
- (31) Incl. *C. stupachenkoi* Mitta, 1998. NB – Examination (in 2014) of own new numerous topotype material of *C-ch. tschernyschewi* (Sokolov, 1912) (Trusovo, Tzilma River, Pechora basin) has proved the conclusion drawn earlier by the author about conformity of *C. stupachenkoi* (from Unzha R.) to *C-ch. tschernyschewi* (see Gulyaev, 2005, 2009, etc.).
- (32) Unfortunately *K.(G.) hildesheimensis* Tintant poorly known. It may be the senior synonym of *K.(G.) russiensis* Mitta.
- (33) *C-ch. uzhovkensis* Gulyaev, 2005 is nom. nov. pro *Cadochamoussetia/Chamoussetia saratovensis* (Callomon et Wright) sensu Mitta, 1999 and Gulyaev, 2001, holotype – l.c., pl. IV, fig. 3 (Gulyaev, 2005, p. 66). Incl. *Ch. stuckenbergii* (Lahusen) sensu Mitta, 2000 (part.) in l.c., pl. 39, fig. 1, 2, pl. 40, fig. 1, 2, pl. 41, fig. 1, 2, ? pl. 42, fig. 1-4 (only). NB – *Amm. stuckenbergii* Lahusen, 1875 itself is a junior synonym of *Ch. chamousseti* (Orb.); in Pechora (own investigation) it comes from the Gowerianus Subzone and associated with true *Ps. boreale* Buckm. and *K.(G.) cf. gowerianus* (Sow.).
- (34) It is the same as “*Ch. croblyoides* (Quenst.)” in Gulyaev, 2005; Gulyaev, Ippolitov, 2013; Gulyaev et al., 2014, etc. Incl. *Ch. stuckenbergii* (Lahusen) sensu Mitta, 2000 (part.) in l.c., pl. 38, fig. 1 (holotype of *Ch. saratovensis*), 2 (only). NB – *Ch. saratovensis* differ from *C-ch. uzhovkensis* mainly by sharpened venter of adult body chamber and more reduced ribbing.