



UNIVERSITÄT HEIDELBERG

Eduardo Koutsoukos

### **CATASTROPHIC EXTINCION EVENT**



 offshore Campos Basin, <u>SE Brazil</u> (piston-core): water depth of 2809m; distal marine K/Pg boundary.





Campos Basin (2809m)



Sample	Abathomphalus intermedius Ab. mavaroensis	Contusotruncana contusa Co. cf. plicata	Co. waifishensis	Globigerinelloides alvarezi	Gilo mutteninus	Gilo. subcarinatus	Globotruncana aegyptiaca	Gtru. arca	Gtru. esnenensis Gtru. gagnebini	Gtru. cf. orientalis	Gtru. rosetta Globotruncanalla havanansis	Gtre. minuta	Gtre. petaloidea	utre. pscnadae Globotruncanita stuarti	Gtri stuartiformis		Hd. monmouthensis	Heterohelix globulosa	Hx. labellosa	Hx. punctulata	Hx. rajagopalani	Hx. striata Laeviheterohelix flabelliformis	L. glabrans	L. pulchra	Planogiopulina acervulinoldes Plg. brazoensis	Plg. carseyae	Plummerita hantkeninoides	Pseugoguembelina costellitera Decur costulata	Psgu. hariaensis	Psgu. palpebra	Pseudotextularia elegans	Ptx. intermedia Ptx. nuttalli	Racemiguembelina fructicosa	Rugoglobigerina hexacamerata	Rugi. macrocephala	Rugi. pennyi Rual. reicheli	Rugl. rugosa	Rugl. rotundata	Rugi. scotti Ventilahrella multicamerata	MICROSPHERULES	Biozone		Stage
122-124 cm	VB										v	в				15																		ve									
126-128 cm	Yn.										*	n				K												v	R					m									
128-130 cm	VB						,	VB								ĭ								1	'B			v	R	VR	VR						VR		/2				
130-132 cm	· · ·					VB		viii.								Za								*						VR	· ``\	/B						1					
132-134 cm	I															JΑ												v	R	VR											P o		5
134-136 cm	I				V	RVR					V	R				JA														VR							VR				1.0	1	<u>a</u> .
136-139 cm	V	3																												VR	VR												Ę
139-141 cm																																											ő
141-143 cm	I														000	R														VR													÷.
143-146 cm	I															¢ν	RVF	1	VR											VR													e
146-149 cm	I															F																											Š
149-151 cm	I															R	VF	2													VR												0
151-153 cm						VB										R														VR													_
153-155 cm	I															Rν	RVF	٧R	V	R								V	R	VR													
155-157.5 cm	I																													VR											P 0		
157.5-160 cm	Vi	RVR				R				VR					Vi	/F		VR	V	R			1	VRV	'R	VR		V	R	VR						Vi	RR	١	/R				
160–162 cm	VRV	۲		VR	F	۲R	R	R	R	R	R٧	RΒ			F	ΖEN	RVF	R	F	3			R		R	R	1	R	VP	ł R	R	P	3	R		B	R		R				
162-164 cm	VR C	RV	RVR	VRV	/R		R	R	R	R	RC	2 R	R	R	F	1	R	R	F	₹ R	VR			R	R	F	1	RF	R VR	t R	F	R P	R VR	R	RI	RR	С		R P	NA F	PI.		upper
164–166 cm	RC	C		VR	V	RVR		R	R		F	٢		R	F	18	RR	R			VR	VF	RC/F		R VP	RR	VR	RF	F VR	R	С	RB	R			RR	C	R	RV	RF	hantk.	Λ.	laastr.

> trans-K/Pg planktic forams

130-

140-

160-

150- **Pg** 

K

reworked or survivors ?

(Appendix 2, Koutsoukos, 2014)



#### Guembelitriidae

#### Parvularugoglobigerina lineage









(Fig. 5, Koutsoukos, 2014)



(Fig. 13, Koutsoukos, 2014)



(Fig. 18, Koutsoukos, 2014)

#### Six main lineages of minute-size planktic foraminifera are characteristic of the Danian → jointly gave rise to nearly all the subsequent Globigerinina families :

Epoch	Bic	zones	Parvula	arugoglobi	gerina			Woodrii	ngina		Chilogu	embelina	Globo	Globoconusa	
Danian	P1	c b a	giapertura lexus	na plexus S extensa S- S - S -	bamensis 	lexus		<u>gularis</u> ytonensis	townensis		morsei	s <i>is</i> plexus			
	Ρα	upper	P. lon	P. eugubi	P. alal	retacea p		W. irre W. cla	. horners	C	Ch. I	nidwayens	ergensis	ictori n.s	
		lower		3	6	s pelitria ci	Ø	Ø		9	?	Ch.m	Gl, daubj∈	GI. v	
Maast.	Plu hantk	mmerita ceninoides				Guem									

- the microperforate, with blunt pustules and perforation cones, triserial to biserial, *Guembelitria-Woodringina* (Guembelitriidae) and *Chiloguembelina* (Chiloguembelinidae) lineage
- 2. the microperforate, hispid, with blunt to sharp-pointed pustules, trochoid to trilobate, *Globoconusa* (Guembelitriidae) lineage
- 3. the microperforate, pustulose to smooth, *Parvularugoglobigerina* (Guembelitriidae) lineage

(Fig. 16, Koutsoukos, 2014)

Six main lineages of minute-size planktic foraminifera are characteristic of the Danian → jointly gave rise to nearly all the subsequent Globigerinina families :



- 4. the cancellate, nonspinose, *Praemurica* (Truncorotaloididae) lineage
- 5. the cancellate, spinose, *Eoglobigerina-Subbotina* (Globigerinidae) lineage
- 6. the cancellate, spinose, *Parasubbotina* (Globigerinidae) lineage



- Upper Zone P 0
   FOs of
  - P. alabamensis



P. extensa W. irregularis P. cf. taurica E. aff. eobulloides

Lowermost Zone P 0
 – FO of
 *P. nikolasi*



# Zone P 0

- Time span ~30 kyr (Berggren & Person, 2005)
- 10 cm in piston core = ~1 cm/3 kyr
  - considerably much slower than modern deep-ocean pelagic sediments (~0.5-1.0 cm/1kr)
  - Some compaction took place
- FOs took place a few kyr after K/Pg event, ~3-6 kyr, possibly even less

• Main radiation events  $(\bigstar) \rightarrow$  "Recovery Repopulation Interval" :



early  $P\alpha$  (ca. 64.97 - 64.94 Ma) - chiefly for the Guembelitriidae, Globigeriniidae & Troncorotaloididae



- late  $P\alpha$  (ca. 64.94 64.9 Ma) chiefly for the Globigeriniidae
  - P $\alpha$  / P1 boundary (ca. 64.9 Ma)  $\rightarrow$  onset of the Dan-C2 hyperthermal event marked by extinction and radiation events
- P 1a early P 1b (ca. 64.5/64 Ma)
- P 1c P 2 (ca. 63/61.2 Ma) chiefly for the Truncorotaloididae
- Most probably induced by major changes in oceanic water-masses as environmental conditions progressively improved, in the aftermath of the K/Pg mass-extinction event.

- Parallel evolutionary trends → adaptive feeding strategies caused by the changing availability of nutrients in the water column, for instance:
  - early Danian:
    - largely dominant planktonic assemblages of herbivorous or passive grazers (probably most of the non-spinose, microperforate, pustulose Guembelitriidae)





 and subordinate carnivorous (spinose, cancellate-walled Globigerinidae)



• Eutrophication of surface waters in the earliest Danian may have inhibited the appearance of endosymbiont-bearing planktonic taxa in the photic zone, favoring, at first, omnivorous and/or carnivorous feeding strategies.

#### - late Danian:

 probable increasing reliance in symbiosis under widespread oceanic low-nutrient conditions (likely the non-spinose, cancellate-walled, globularchambered Truncorotaloididae)



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#### PHENOTYPIC PLASTICITY, SPECIATION, AND PHYLOGENY IN EARLY DANIAN PLANKTIC FORAMINIFERA

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v. 44, no. 2, pp. 109-142, April 2014

Unterstützt von / Supported by



## Alexander von Humboldt Stiftung/Foundation

Study sponsored by research fellowships from the Alexander von Humboldt Foundation, Germany, during three periods at the University of Heidelberg, March-June 2009, March-May 2012 and March-April 2014, which are most gratefully acknowledged.

