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# **Discovery of the genus *Erymnoceras* from the Middle Callovian of Kachchh, Western India: Paleontological, stratigraphical and paleobiogeographical implications**

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with 1 plate and 2 figures

**Abstract.** The pachyceratid ammonoid genus *Erymnoceras* is described and illustrated through a new species *E. jumarensis* from the late Middle Callovian sediments of Jumara dome, Kachchh, Western India. Stratigraphically, the discovery helps the identification of the standard *coronatum* Zone in Kachchh (an area of primary reference in the Eastern Tethys) and allows precise correlations with Western Europe. Paleobiogeographically, this is the southernmost occurrence of *Erymnoceras* from anywhere in the world, and significantly not only the first record from the Indian subcontinent, but the entire Indo-East-African faunal province on the South margin of the Tethys.

## **A Introduction**

The rich and diverse ammonoid fauna of Kachchh, Western India has been well known through the early works of SOWERBY (1840), WAAGEN (1873-75) and SPATH (1927-33). However, among the numerous taxa described from the classic sections of this region, the well known West Tethyan family Pachyceratidae has been very poorly represented in number of genera as also specimens known. Up-to-date family Pachyceratidae includes 3 genera split up into 6 subgenera (ARKELL in MOORE 1957, CALLOMON in DONOVAN et al., 1981) and ranges in age from Middle Callovian to Upper Oxfordian; in Kachchh the family has been only known through the solitary genus *Pachyceras* from Upper Callovian (SPATH, op. cit., THIERRY 1980). For the first time one of us (J.K.) collecting new faunas in the classical Kachchh sections had the good luck to find a single but undoubted and typical specimen of *Erym-*

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*noceras* from beds 4–3 (RAJNATH 1932, KRISHNA 1984) of Jumara dome section north of Jumara village, Kachchh (Fig. 1). *Erymnoceras* is a characteristic marker of late Middle Callovian *Coronatum* Zone, named after one of its species, *Erymnoceras coronatum*, a well known West European species. Around implications of this important discovery are discussed here in context of Callovian ammonoid systematics, biostratigraphy and paleobiogeography in the Tethyan realm.

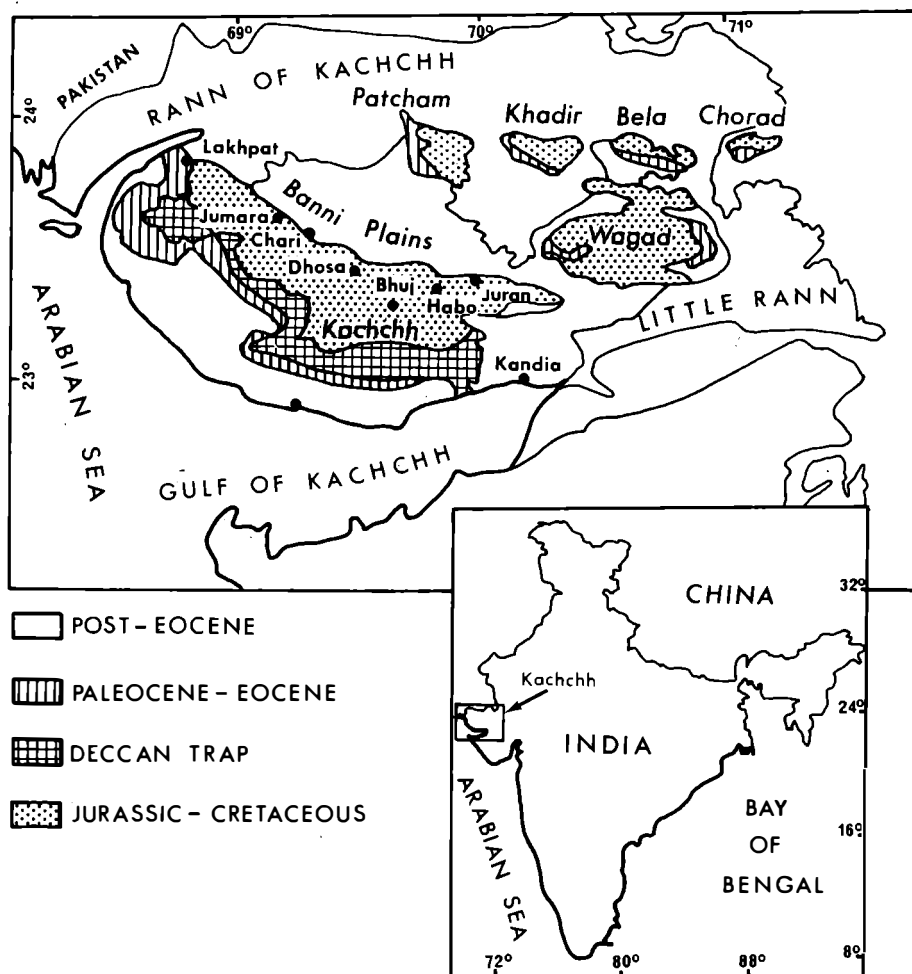


Fig. 1. Simplified geological map of Kachchh with names of villages and Jurassic domes. (Erratum: read Kandla for Kandia at the center of the main figure.)

## B Systematics and description of the specimen

Superfamily Stephanocerataceae

Family Pachyceratidae

Genus *Erymnoceras* Hyatt, 1900

*Erymnoceras jumarensis* nov. sp.

pl. 1, Fig. 1 a, b, c, d

Derivatio nominis: Named after the locality of Jumara, Kachchh, Western India

Type locality: Jumara dome section, North of the Jumara village

Holotype: specimen JM/4-83 J.K. Collection, Banaras Hindu University, India

Type horizon: Beds 4-3 (RAJ NATH, 1932; KRISHNA, 1984)

Measurements:

D	H	h	E	e	O	o	E/H	N/2	n/2
91	34	0.37	52	0.57	31	0.34	1.53	7	21 (?)
89	28	0.31	48	0.54	34	0.38	1.71	8	28
73	26	0.36	46	0.63	26	0.36	1.77	9	30

### 1 General morphology

The only collected specimen (J.M./4-83) is preserved until a diameter of 91 mm, but according to the pattern of coiling and the lay-out of the umbilical wall left by the broken body-chamber (Pl. 1, Fig. 1 a, b) coupled with a calculated growth rate of 1.25 per half-whorl it may reach a fully evolved diameter of 115 mm.

Suture lines are not clearly visible; however the last one, between body chamber and phragmocône may be near  $\frac{3}{4}$  of the end of the preserved shell (thin black arrow on Fig. 1 a). According to the lay-out of coiling and the umbilical wall, it is clearly visible that the umbilicus is rapidly widening as in adult specimens. Thus, we can presume that our specimen is an adult with a  $1\frac{1}{4}$  whorl body-chamber.

In general, on the last  $1\frac{1}{4}$  well preserved whorl of the specimen, the shell shape is typically *Erymnoceras*-like with a cadicone aspect: depressed whorl section and wide umbilicus (see the above measurement table) in spite of the effect of a slight ventrodorsal crushing of the specimen. The venter, the flanks and the umbilical wall are regularly rounded.

The ribbing shows very coarse primaries initiating on the umbilical wall and going up beyond the middle of the flanks and never tuberculate. They divide into three coarse and somewhat slightly projected secondaries with occasional intercalaries.

The inner whorls are not well preserved, but on the portion which is visible, the thickness of the whorl section seems to increase whereas the ribbing is slightly sharper and closer.

It is not possible to draw and describe in detail the suture line; but, the two or three lobes and saddles which are visible, are wide and scarcely divided as in *Erymnoceras*.

Finally, the general morphology and the size of the shell, the width of the umbilicus, the coarsening of the ribs in the last half-whorl of the coiling and the position of the last suture line are good arguments to assume that it may be an adult macroconch.

## 2 Discussion and comparison with other species

According to the above description, the present specimen appears small enough in size in comparison to all the other known species which reach 200 to 250 mm in diameter like the macroconch morph of *Erymnoceras coronatum* (BRUGUIERE) or *E. baylei* JEANNET (in CARIOU 1980; pl.2, Fig. 1 a-b).

Its size is in fact closer to the microconch morphs up to now described as *E. baylei* JEANNET (in JEANNET 1951, pl. 40, fig. 3 and 9; in CARIOU 1980; pl. 2, fig. 1 a-b) or *E. renardi* (NIKITIN 1881, pl. 4, fig. 24 ab) etc. . . But, in these microconch morphs, the thickness of the whorl section is not so important and the umbilicus is much wider at an equal diameter; the ribs are coarser and sharper with tubercle-like swelling at the point of division and the ribbing is less dense with only two secondaries per primary and rare intercalaries.

Once more, comparing the total size of our specimen with other known species, it is on one hand, a little smaller than *E. (Pachyerymnoceras?) philbyi* IMLAY (in LEWY 1983) and *E. baylei* JEANNET (in GILL, THIERRY, TINTANT 1985, pl. 1, fig. 1 a-b, pl. 3, fig. 1 a-b) both coming from Middle East (Jebel Tuwaiq, Saudi Arabia and Hamakhtesh Hagadol, Israel) that reach 150 to 180 mm. But, on the other hand, our specimen has a less depressed whorl section, a narrower umbilicus and thinner ribbing.

- The best closely sized figured *Erymnoceras* comes from Caucasus (LOMINADZE 1970, pl. 2, fig. 1) which when complete, seems to reach 120mm with a one whorl body chamber and a widening umbilicus in the last whorl. The ribbing is very similar except for the primaries which are tubercle-like at the point of division.

Thus, in its general aspect, except for the adult size, the closest still known species is *E. baylei* JEANNET (in CARIOU op. cit.).

It is very clear from the reasons stated above coupled with lack of record of a comparable shell in spite of abundant literature and figuration about the genus *Erymnoceras*, that our specimen cannot be identified with any known species. Hence, a new species *Erymnoceras jumarensis* is proposed for this Indian specimen.

### Plate 1

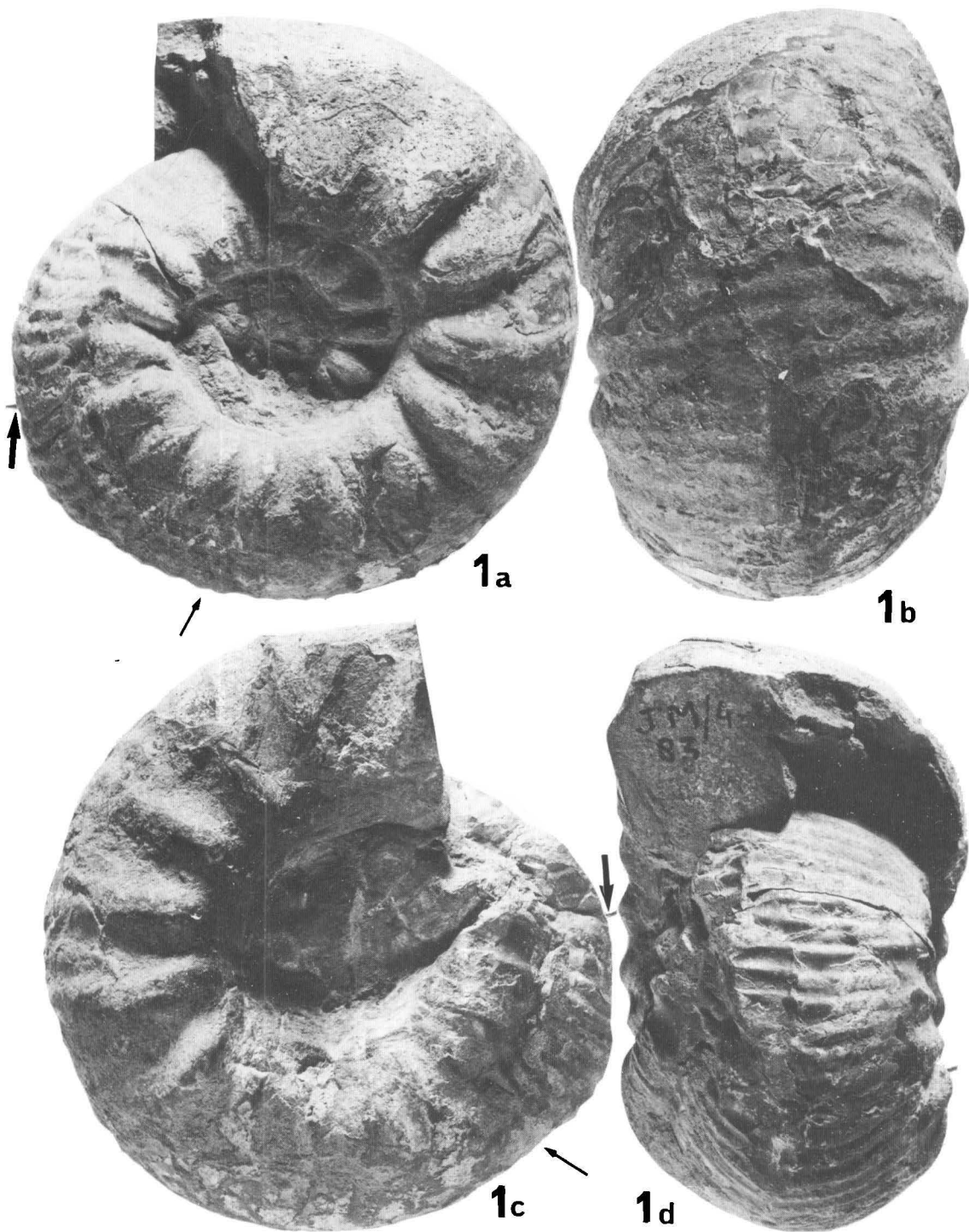
Fig. 1a. *Erymnoceras jumarensis* sp. nov. Jumara, Kachchh, Western India, n° J.M./4-83. J. Krishna coll. Banaras Hindu Univ. Lateral view.

Fig. 1b. Same specimen, ventral view.

Fig. 1c. Same specimen, opposite lateral view.

Fig. 1d. Same specimen, oral view.

All photos in natural size; the thin black arrow shows the lay out of the umbilical wall, the thick black arrow shows the position of the last visible suture line.



## C Implications of the discovery

### 1 Paleontological implications

One of us (J.T.) has examined over the years hundreds of *Erymnoceras* coming from different localities of Western Europe, North Africa and Middle East, and according to us *E. jumarensis* sp. nov. in spite of being based on a single specimen clearly represents a new species closely related with the European *E. baylei* JEANNET. We further hope that in near future more *Erymnoceras* would be collected from Kachchh to confirm and strengthen our observations besides allowing study of the variability of this new taxa.

### 2 Stratigraphical and biostratigraphical implications (Fig. 2)

*Erymnoceras jumarensis* sp. nov. has been collected from the middle of beds 4–3 of Jumara dome succession (RAJNATH 1932, KRISHNA 1984, KRISHNA & WESTERMANN 1985) which were referred to the so called "Anceps beds" by SPATH (1933). The presence of *Erymnoceras* recently allowed precise assignment and correlation of these beds to the standard *Coronatum* Zone of Western Europe (KRISHNA 1984). The underlying and overlying (respectively beds 5 and 2) beds also have been referred respectively to top of the *anceps* and base of the *athleta* Zones (KRISHNA op cit.). The discovery of *Erymnoceras* also helps to precisely date some Indian endemic genera like *Hubertoceras*, *Obtusicosites* and *Kinkeliniceras* which occur stratigraphically close to the level of *E. jumarensis* sp. nov. Moreover this also proves that these proplanutilids and similar ammonoids are stratigraphically much younger than the European stock (CARIOU 1980, KRISHNA & WESTERMANN 1985). Significantly the present find of *Erymnoceras* signals the first presence of the erymnoceratid stock in the Middle Callovian of Kachchh or India, since earlier the family has been only known through *Pachyceras indicum* SPATH from the Upper Collovian. Thus, it permits to better the stratigraphic record of the family in Kachchh to Middle and Upper Callovian.

### 3 Paleobiogeographical implications

The family Pachyceratidae is very rare and poorly represented in the Indian subcontinent as also in the Indo-East-African faunal province (also termed Ethiopian or Indo-Malagasy). Until now, the genus was completely unknown not only in the Indian subcontinent but the entire faunal province; however, the family Pachyceratidae was known through rare records from only Upper Callovian levels in Kachchh – *Pachyceras indicum* SPATH, 1933, *P. distinctum* SPATH, 1933, *Pachyerymnoceras dorothea* SPATH, 1933 and *Pachyceras arenosum* (WAGGEN) 1873–75, in THIERRY 1980; in Malagasy – *Pachyerymnoceras besairiei* COLLIGNON, 1968 and in Ethiopia – *Pachyerymnoceras imlayi* ZEISS and *P. jarryi* R. DOUVILLE *aethiopicum* ZEISS, in ZEISS 1974. The nearest geographical record of *Erymnoceras* until now has been from the Middle East (LEWY 1973, GILL, THIERRY & TINTANT 1985) and the Kachchh discovery demarcates the southernmost distribution limit of this genus and family.

Previously, it was hypothesized that the stock had its origin in the Middle Callovian in the Middle East (GILL & TINTANT 1975, THIERRY 1976, ENAY & MANGOLD 1982) in the so called

"Arabo-Ethiopian realm"; it is obligatory now to allow that the family rapidly registered geographical expansion to as far south as Kachchh, Western India in the middle Callovian itself, instead of slow spread in Upper Callovian. Further, like many other Callovian-Oxfordian

European Submediterranean zonation Center-West of France (CARIOU, 1984)			Kachchh zonation		
			(KRISHNA) 1984	RAJNATH 1932	SPATH (1927 - 1933)
ZONES	SUBZONES	HORIZONS	ZONES	beds in Jumara	ZONES / BEDS
« LAMBERTI »	Gap		UNNAMED	1 a	Upper Athleta 1 a 2 Lower Athleta 3
	Poculum	Athletoides			
		Subtense			
		Nodulosum			
ATHLETA	Collotiformis	Collotiformis	ATHLETA	2	
		Piveteaui			
	Trezeense	Trezeense			
CORONATUM	Leuthardt	Rota	«CORONATUM»	4 - 3	Upper Anceps 4
		Waageni			
		Leuthardt			
	Baylei	Baylei			
		Villanyensis			
ANCEPS	Tyranniformis	Richei	ANCEPS	6 - 5	Lower Anceps 5
		Blyensis			
		Turgidum			
	Stuabelli	Bannense			
GRACILIS	Patina	Kiliani	OPIS	9 - 7	Rehmanni 9 - 6
		Boginense			
	Michalekii	Michalekii	SEMILAEVIS	13 - 10	Diadematus (Tumidus) 13 - 10
	Laugier	Laugier			
	Pictava	Pictava			
	Rehmanni	Rehmanni	DIMERUS	21 - 14	Dimerus (Herveyi) 21 - 14
MACROCEPHALUS	Prahequeuae	Prahequeuae			
	Bullatus	Bullatus			

Fig. 2. Table of correlation between Kachchh zonation and standard South-West European zonation (from CARIOU & KRISHNA, in press).

dian Tethyan genera, absence of *Erymnoceras* or Pachyceritidae farther south from Western India may also support the non-existence of a direct marine connection between the Indo-East-African faunal province areas and the Andean faunal province areas during this time (KRISHNA 1983 and 1984).

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