

REVISION OF THE AGE OF HETEROMORPH AMMONITE PARAPATOCERAS FROM KACHCHH, WESTERN INDIA

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ABSTRACT

The present paper deals with the stratigraphic position of the heteromorph ammonite *Parapatoceras* Spath in the Jurassics of Kachchh, western India. The previous record of *Ancyloceras calloviense* Morris by Waagen (1875) and later refigured by Spath (1924, 1927-33) as *Parapatoceras cf. calloviense* (Morris) has now been considered as junior synonym of *Parapatoceras distans* (Baugier & Sauzé). In the present work, two species of *Parapatoceras* Spath, i.e., *Parapatoceras tuberculatum* (Baugier & Sauzé) and *Parapatoceras distans* (Baugier & Sauzé) are described and illustrated. *Parapatoceras distans* (Baugier & Sauzé) is here reported to range from ?Middle-Upper Bathonian to Middle Callovian.

INTRODUCTION

The peri-cratonic Kachchh shelf basin is situated at the southern end of the Indus plate, extending between the Nagar Parker-Tharad ridge in the north and Kathiawar (Saurashtra) uplift in the south (fig. 1). The basin is known for its well exposed outcrops of the Middle Jurassic (Bajocian-Callovian) sediments and for its well preserved ammonites (Waagen, 1875; Spath, 1927-33; Rajnath, 1942, 1932; Callomon, 1993; Jain, 1994; Jain, Callomon and Pandey, 1996) and Jain, 1997. The sediments crop out either in anticlinal fault ridges in the north (Pachchham, Khadir, Beia, Chorad Islands) or in Domes in the south (Mainland: Jara, Jumara, Nara, Keera, Jhura, Habo Domes, etc.).

Spath (1924) erected the new genus *Parapatoceras* and refigured specimens from Middle Callovian beds of the Nara Dome (East of the Jumara Dome), initially described by Waagen (1875, p. 212), as *Parapatoceras cf. calloviense* (Morris). Recently, *Parapatoceras tuberculatum* (Baugier & Sauzé) has been recorded from Lower Callovian (?Middle Callovian) beds of Gora Dongar, Pachchham Island, Kachchh (Pandey, Callomon & Fürsich 1994). In Madagascar also, *Parapatoceras* occurs in Lower Callovian beds (Collignon, 1958). In Europe, it ranges from Upper Bathonian to Lower Callovian (Dietl, 1978; Dietl, 1994).

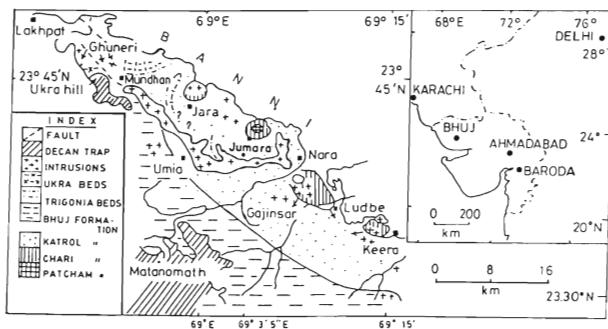


Fig. 1. Map of the Jurassic outcrops in Kachchh, India, with some important localities (after Raj Nath, 1932).

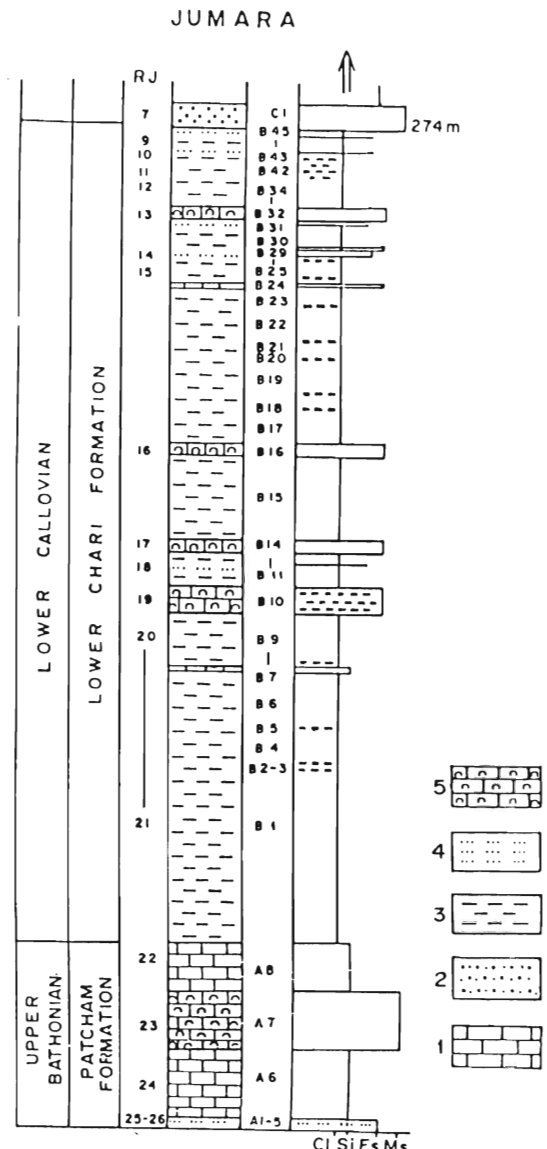


Fig. 2. Stratigraphic sections at the Jumara Domes.

Key : 1, cream coloured limestone; 2, Oolitic limestone; 3, Sandstone, occasionally oolitic; 4, Shale; 5, Siltstone; 6, Packstone/Wackstone. Cl: Clay; Si: Silt; Fs: Fine sand; Ms: Medium sand. Dark dashes within the section indicates concretion levels.

Ancyloceras calloviense Morris [= *Parapatoceras* cf. *calloviense* (Morris) (Waagen, 1875; Spath, 1928)] has been considered the junior synonym of *Parapatoceras distans* (Baugier & Sauzé) (Dietl, 1978, p. 46). The present work deals with the description and illustration of *Parapatoceras tuberculatum* (Baugier & Sauzé) and *Parapatoceras distans* (Baugier & Sauzé) from Gora Dongar, Pachchham Island (northern anticlinal ridge), Jara and Jumara Domes (southern Mainland), Kachchh, western India.

In the Jumara Dome, *Parapatoceras distans* (Baugier & Sauzé) has been found associated with *Procerites hians* (Waagen) (M & m), *Procerites* cf. or aff. *hosoni* Arkell (M), *Siemiradzka* cf. or aff. *verciacensis* (Lissajous) (m), *Sivajiceras congener* (Waagen) (M & m) *Macrocephalites triangularis* Spath (M & m), and *Reineckeia* sp. (Jain, Callomon and Pandey 1996) from bed no. A4 (bed no. 26 of Raj Nath, 1942) of ?Middle Bathonian to latest Late Bathonian age (fig.2). The second specimen comes from bed no. B14 (bed no. 17 of Raj Nath, 1942) along with *Macrocephalites diadematus* Spath, *M. elephantinus* (J. De. C. Sowerby), *M. lamellosus* (J. De. C. Sowerby) and *M. transitorius* Spath of Lower Callovian age (fig.2) and a rare early *Indosphinctes peregrinus* Spath. Therefore, its range has been extended from ?Middle Bathonian to Middle Callovian in Kachchh (fig. 3).

The Jumara specimens of *Parapatoceras tuberculatum* (Sauzé) have been found in association with *M. triangularis* Spath (M), *M. subcompressus* (Waagen) (m), *Sivajiceras congener* (Waagen) (M), *M. madagascariensis* Lemonei (M), *M. cf. dimerus* and *Choffatia* sp. from Bed no. A6 (bed no. 24 of Rajnath, 1942) of Upper Bathonian age (Callomon, 1993). The other specimens, from bed no. B31 are associated with *M. formosus* (J. De. C. Sowerby), *Subgrossouwia gudjinsirensis* var. *tenuis* Spath, *Indosphinctes peregrinus* Spath and *Indosphinctes urbanus* Spath from bed no. B14 (association mentioned above) both of Lower Callovian age. Therefore, the lower range of *Parapatoceras tuberculatum* has been extended down to Upper Bathonian (fig. 3). In the Jara dome, *Parapatoceras tuberculatum* occurs in typical *Macrocephalus* beds (Spath 1927 - 1933) of Lower Callovian age, associated with the macrocephalid fauna.

In Gora Dongar (Pachchham Island), both *Parapatoceras distans* and *Parapatoceras tuberculatum* (Baugier & Sauzé) occur together in association with *Subgrossouwia morley daviesi* Spath and *Hecticoceras* ? sp. in bed no. 29 (Agrawal and Pandey, 1985, p. 889), which also has yielded a rich assemblage of *formosus-dimerus-lamellosus-magnumbilicatus* fauna (Agrawal and Pandey, 1985, p.895) (See also Pl. II, fig. 3). Before the record of *Subgrossouwia morley daviesi* Spath and *Hecticoceras* ? sp.

Species	Locality	Bathonian		Callovian	
		Middle	Upper	Lower	Middle
<i>P. tuberculatum</i>	Europe				
	Kachchh				?
<i>P. distans</i>	Europe				
	Kachchh	?			

Fig.3. Stratigraphic range of *P. tuberculatum* and *P. distans* in European and Kachchh (modified after Dietl, 1978;20).

in bed no. 29, this bed was dated as late Lower Callovian. But the above two species support a late Lower Callovian to early Middle Callovian age.

All the specimens are lodged at the Palaeontological Laboratory, Department of Geology, University of Rajasthan, Jaipur, India.

SYSTEMATIC PALAEOLOGY

Superfamily Spiroceratacea Hyatt, 1900

Family Spiroceratidae Hyatt, 1900

Subfamily Parapatoceratinae Buckman, 1926

Genus *Parapatoceras* Spath, 1924

Type species: *Ancyloceras calloviense* Morris, 1845

Parapatoceras tuberculatum (Baugier & Sauzé, 1843)
(Pl. I, figs. 1 - 9; fig. 4)

Taxoceras ? *tuberculatum* Baugier & Sauzé, 1843, p. 11, pl. 4, figs. 1-2.

Ancyloceras calloviense - Morris, 1845, p. 32, pl. 6, figs. 3a, 3c-d.

Ancyloceras spinatus (Baugier & Sauzé) - d'Orbigny, 1850, p.584, pl. 228, figs. 6-9.

Ancyloceras calloviense Morris- d'Orbigny. 1850, p.588, pl.230, fig. 1-4.

Parapatoceras tuberculatum (Baugier & Sauzé)-Dietl, 1978, p.44, pl. 7, fig. 11 Pl. 8, fig.1 (topotypes, ?syntypes); pl. 8, figs. 2-5. - Pandey, Callomon & Fürsich, 1993, p.66, figs. 2-7. - Enay *et al.*, 1994, p. 191, pl.90, fig.7a-b, p.192, pl.90, figs. 3a-c.

Material : Six fragmentary specimens (Ju/9/76, Ju/9/77, Ju/12/53, Ju/12/177a, RUC1994I 231 & 232).

Dimensions :

Total length of the shell	31.3 mm
Length of the phragmocone	26.0 mm
Length of the body chamber	5.5 mm
Thickness / Height	1.0 - 0.96
Rib density per 5 mm	3
Angle of inclination of ribs	15
Space between septa	2.7 mm

Description: The specimens are medium sized, tuberculate, slightly curved and strongly ribbed. The later stage phragmocone is cyrtoconic, whorl section circular. The lateral surface of the whorl bears inclined, regular and well-spaced simple ribs which pass over dorsal

region, but terminate with a tubercle just short of the mid ventral line leaving a narrow smooth band. There is another row of less prominent tubercles along the ventro-lateral edge. This second row appear only at a later stage of growth of the phragmocone.

The suture line on the midventral area has a rounded W shaped lobe, followed by a first saddle with a mid secondary lobe, a moderately deep lateral lobe, a second saddle with a mid secondary lobe, second lateral lobe, third saddle with a mid secondary lobe and mid dorsal U shaped lobe with an incipient secondary saddle (fig.4).

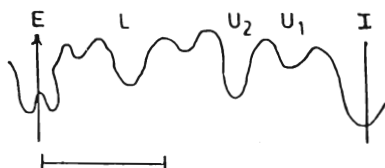


Fig. 4. Suture line of *Parapatoceras tuberculatum*. Scale Bar = 3 mm; Sample No. Ju/9/76.

Remarks : The form, whorl section, ribbing, tubercles, and the pattern of suture line are similar to that of *Parapatoceras tuberculatum* (Baugier and Sauzé) (Dietl, 1978 : 58, figs. 13 c and d). However, in Jumara specimens, the second lateral lobe is larger throughout. The early part of the shell with protoconch is missing. The Khavda specimen (Pandey, Callomon and Fürsich, 1993, p. 67, fig. 7) too have similar suture but the first lateral saddle is more broad and frilled.

Occurrence and Age : Upper Bathonian; Nodular limestone in bed no. A6 (Patcham Formation). North-west of the village of Jumara, Kachchh (Pl. I, fig. 6; Pl. II, fig.1 is of *Parapatoceras* sp. from the same bed.)

Lower Callovian; Ferruginous fossiliferous siltstone in bed no. B14 (Pl. I, figs. 4 and 7-8) and Yellow siltstone bed in bed no. B31 (Pl. I, fig. 5) (Lower Chari Formation). North-west of the village of Jumara, Kachchh.

Lower Callovian; *Macrocephalus* Beds (Lower Chari Formation). Jara Dome, Kachchh (Pl. I, fig. 9).

Parapatoceras distans (Baugier & Sauze, 1843)
(Pl. I, figs. 10-12; Pl. II, figs. 2, 4-10)

Ancyloceras distans Baugier & Sauzé, 1843, p. 13, pl. 3, figs. 8-10.

Ancyloceras distans (Baugier & Sauzé) - d'Orbigny, 1850, p.589, pl. 230, figs. 5-8.

Ancyloceras calloviense Morris - Waagen, 1875, p. 212, pl. 56, fig.3.

Parapatoceras cf. *calloviense* (Morris) - Spath. 1928 p. 277, pl. 33, figs. 3a-c.

Parapatoceras distans (Baugier & Sauzé) - Dietl, 1978, p.46, pl. 8, figs. 7-11; pl. 9, figs. 1-2; pl 10, fig. 4; pl.11, figs. 2-4. - Sandoval, Westermann & Marshall, 1990, p. 124, pl.4, figs. 59. - Enay *et al.*, 1994, p.192, pl. 90, figs. 5a-b.

Material : Six specimens (Ju/12/174, Ju/12/174a, Ju/12/177, Ju/27/4 & RUC1994I 233-234).

<i>Dimensions :</i>	RUC	RUC
	1994I 233	1994I 234
Total length of the shell	27.8 mm	22.2 mm
Length of the phragmocone	3.0 mm	9.0 mm
Length of the body chamber	24.8 mm	12.8 mm
Thickness/Height	0.83-0.94	0.81-0.87
Rib density per 2 mm on the body chamber	2	2
Rib density per 2 mm on the phragmocone	3	3
Space between septa	0.90 mm	-

Description: Shell incomplete, broken at both the ends, but major part of the phragmocone and half of the body chamber is well preserved. This part of the shell makes a sudden curve. Surface ornamented with simple, inclined and distantly spaced ribs, which are faint during early growth stages but become gradually thicker towards the end of the phragmocone. The dorsal component of the ribs also become broad and prominent. The tubercles start early with only two rows of spine-like ventral tubercles. The second row of tubercles appear with incipient knot-like structure along the ventrolateral edge on the early part of the phragmocone, gradually becomes prominent at the end of the phragmocone and in turn becomes spiny on the later part of the body chamber. At the end of the body chamber, both the tubercles disappear and less pronounced ribs ornament the surface around the aperture. The ventral region (i.e., between two rows of the ventral tubercles) is smooth. The ventral one-sixth lateral part (i.e., between ventral row of tubercles and those of ventrolateral edge) of the shell is either smooth or bears very faint ribs.

Suture line is barely visible. The first lateral lobe is shallow, followed by a broad almost flat second lateral saddle and deep acutely rounded second lateral lobe. The pattern of ventral and dorsal lobes are not clearly visible.

Remarks : According to Sandoval, Westermann and Marshall (1990), the whorl section may change through ontogeny. It is transversely ovate in the early stage, circular in the middle stage and dorsoventrally ovate in the adult stage. In the mature stage, the ribs become straight and prominent as also seen in the Kachchh specimens.

Occurrence and Age : ?Middle Bathonian to Latest Late Bathonian; Yellow, silty, fossiliferous limestone in bed no. A4 (Pl. II, fig. 4) (Patcham Formation). North-west of the village of Jumara, Kachchh.

Lower Callovian; Ferruginous fossiliferous siltstone in bed no. B14 (Pl. I, figs. 10-12) (Lower Chari Formation). North-west of the village of Jumara, Kachchh.

Lower Callovian - ?Middle Callovian; Purple and yellowish brown concretionary ferruginous siltstone in bed no. 29 (Pl. II, figs. 3 and 7-10) (Lower Chari Formation). Gora Dongar, Pachchham Island, Kachchh.

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EXPLANATION OF PLATES

Plate I

- 1-8 *Parapatoceras tuberculatum* (Baugier & Sauzé)
1. Ventral view ' 4; Sample No. Ju/9/76.
 2. Side view ' 4; Sample No. Ju/9/76.
 3. Dorsal view ' 4; Sample No. Ju/9/76.
 4. Side view ' 4.4; Sample No. Ju/12/177a.
 5. Side view ' 3; Sample No. Ju/9/77.
 6. Side view ' 3; Sample No. RUC19941 231.
 7. Ventral view ' 4; Sample No. Ju/12/175.
 8. Side view ' 4; Sample No. Ju/12/53.
 9. Side view ' 0.8; Sample No. RUC19941 232.
- 10-13. *Parapatoceras distans* (Baugier & Sauzé)
10. Side view x 4; Sample No. Ju/12/174.
 11. Side view x 4; Sample No. Ju/12/177.

12. Side view x 4; Sample No. Ju/12/174a.
13. *Parapapatoceras* bed (Bed No. B14 of Present work with *Indosphinctes peregrinus*) ' 0.6

Plate II

1. *Parapapatoceras* sp. ' 3; Sample No. Ju/A6/176
 2. Waagen's specimen refigured from Spath's pl. 33, Fig.3 ' 3.(= *P. distans*).
 3. Purple and yellowish brown concretionary ferruginous siltstone in bed no. 29 (Lower Chari Formation). Gora Dongar, Pachchham Island, ' 0.6. Note the presence of *Hecticoceras* sp. (Centre) and of *M. dimerus* indicating it to be a condensed bed.
- 4-10. *Parapatoceras distans* (Baugier & Sauzé)
4. Side view x 2.6; Sample No. Ju/27/4.
 - 5-6. *Parapapatoceras distans* (Holotype) from the collection of Baugier (refigured from Enay *et al.*, 1994, pl. 90, Figs.5a-b) ' 1.6.
 5. Side view ' 1.6
 6. Ventral view ' 1.6
 7. Side view x 4.6; Sample No. RUC19941 233.
 8. Ventral view x 4.6; Sample No. RUC19941 233.
 9. Side view x 4.4; Sample No. RUC19941 234.
 10. Side view x 4.4; Sample No. RUC19941 234.

