HABO BEDS NEAR LER (KUTCH) : Pt. 3—BIOSTRATIGRAPHY OF THE BEDS ON THE EAST OF LER

S. K. AGRAWAL
Department of Geology, Banaras Hindu University, Varanasi 221 005

and

R. P. KACHHARA
Department of Geology, University of Rajasthan, Udaipur 313 001

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The present paper gives the check lists and distribution of the species of bivalves and ammonoids from the east of the village of Ler (23°11′53″ N : 69°48′10″ E). Correlation of the Habo beds of the area has been attempted on the basis of these molluscs. The youngest bed, No. 1, is Mebha Oolite and assigned to Callovo-Oxfordian. Bed No. 2 corresponds to Athleta Beds whereas Bed Nos. 3 to 16, and perhaps even Bed No. 17, can be grouped into Reineckeia Beds of Callovian age.

INTRODUCTION

THE preceding publication (Agrawal & Kachhara, 1977) incorporates a preliminary account of the fossil molluscs and succession of Habo (= Chari) beds on the east of the village of Ler (23° 11′ 53″ N : 69° 48′ 10″ E) where they form two quaquaversal units. It is now intended to discuss here the biostratigraphy of these beds on the basis of bivalves and ammonoids. Since the succession of constituent seventeen beds in both the units is exactly the same, a particular bed number, for the purpose of discussion, stands for the entire area, i.e., east of Ler. Accordingly any fact/evidence for and from a bed, and even the beds younger (i.e., bed with a lower number) and older (i.e., bed with a higher number) than it, will be taken into consideration irrespective of the unit whether eastern or western which will be referred to in the following pages as central unit because of its position among the three exposures of Habo beds in the neighbourhood of Ler (also see Agrawal & Kachhara, *op. cit.*, p. 495).

DISTRIBUTION OF BIVALVES AND AMMONOIDS

The rich collection of megafossils from the east of Ler consists of over 1,800 specimens of bivalves and 600 of ammonoids. About 300 individuals of the former and 360 of the latter have been left out due to their bad preservation. The bivalves comprise 130 forms whereas ammonoids 104 only; either includes one subspecies. The checklists of the species and their vertical as also lateral distribution are given in Tables I and II respectively.

In both the tables, the figures in horizontal row at the top refer to the numbers of fossiliferous beds while those in vertical columns below them indicate the number

TABLE I

Distribution of the bivalves

S. No.	Species	Bed Nos.	16		14		13		11		7		5		4		3		2		1	
			C	E	C	E	C	E	C	E	C	E	C	E	C	E	C	E	C	E	C	E
1.	*Palaeonucula cuneiformis* (J. de C. Sow.)		1		2		1				1	2		2	1				2	2	1	1
2.	*Palaeonucula blanfordi* Cox												2	2	1	1			4	1	8	3
3.	*Palaeonucula rodei* sp. nov.																			1		
4.	*Nuculoma wynnei* Cox ..																		4	23		
5.	*Nuculoma agrawali* sp. nov.																				1	
6.	*Palaeoneilo* cf. *indicus* Cox																				1	
7.	*Nuculana* (*Praesaccella*) *juriana* Cox																		1	1	1	1
8.	*Nuculana* (*Rollieria*) cf. *meriani* (Rollier)																		1			
9.	*Dacromya lacryma* (J. de C. Sow.)																			1		
10.	*Reticulana calloviensis* Kanjilal and Singh																		1	2		
11.	*Arca* (*Eonavicula*) *chaudharii* sp. nov.										1								1		2	1
12.	*Barbatia* sp. nov.																			1		
13.	*Grammatodon* (*Grammatodon*) *jurianus* Cox										1								7	4	2	5
14.	*Grammatodon* (*Grammatodon*) *pandyai* sp. nov.																					1
15.	*Grammatodon* (*Indogrammatodon*) *virgatus* (J. de C. Sow.) ..						5		1			3	1	1					12	5	7	3
16.	*Grammatodon* (*Indogrammatodon*) *blakei* Cox																			2		1
17.	*Grammatodon* (*Indogrammatodon*) cf. *blakei* Cox																					1
18.	*Grammatodon* (*Indogrammatodon*) sp.																			1		1
19.	*Cucullaea* (*Cucullaea*) cf. *coxi* Agrawal						1															
20.	*Megacucullaea* sp.																				2	
21.	*Lithophaga* (*Lithophaga*) *febella* (J.A. Eudes-Deslongchamps)												1									
22.	*Lithophaga* (*Lithophaga*) cf. *inclusa* (Phillips)																				1	1
23.	*Lithophaga* (*Lithophaga*) sp.																		1			1
24.	*Inoperna glendayi* Weir ..													2		1					1	3

TABLE I (*continued*)

S. No	Species	Bed Nos.	16		14		13		11		7		5		4		3		2		1	
			C	E	C	E	C	E	C	E	C	E	C	E	C	E	C	E	C	E	C	E
25.	*Inoperna sowerbianus* (d'Orb.)																		6			
26.	*Modiolus* (*Modiolus*) *agrawali* sp. nov. (in Singh MS) ..										1		2									
27.	*Modiolus* (*Modiolus*) sp. ..											1										
28.	*Falcimytilus* sp.											1										
29.	*Pinna stoliczkai* Cox ..																				1	2
30.	*Trichites* cf. *gemmellaroi* Choffat																				1	
31.	*Bakevellia waltoni* (Lycett) ..																					1
32.	*Bakevellia* (s.l.) sp.										1											
33.	*Pteroperna blakei* Cox ..											1							2	1		
34.	*Pteroperna shuklai* sp. nov. (in Singh MS)																		1		2	
35.	*Gervillella siliqua* (J. A. Eudes-Deslongchamps)																		3	1	1	
36.	*Inoceramus* (*Inoceramus*) *sharmai* sp. nov.																		1			
37.	*Inoceramus* (*Inoceramus*) *coxi* sp. nov.																		1			1
38	*Bositra buchi* (Roemer) ..																		1			
39.	*Oxytoma* (*Oxytoma*) *inequivalvis* (J. Sow.)																				3	1
40.	*Oxytoma* (*Oxytoma*) *censoriensis* (Cotteau)																				2	1
41.	*Oxytoma* (*Oxytoma*) *agrawali* sp. nov.																				1	
42.	*Oxytoma* (*Oxytoma*) sp. ind																				1	1
43	*Entolium* (*Entolium*) *corneolus* (Young and Bird)										1											
44.	*Entolium* (*Entolium*) *partitum* (J. de C. Sow.)																			2	9	5
45.	*Camptonectes* (*Camptonectes*) *auritus* (Schlotheim) ..										1								4	1	6	2
46.	*Camptonectes* (*Camptonectes*) aff. *auritus* (Schlotheim) ..																		1		1	
47.	*Camptonectes* (*Camptonectes*) *indicus* Cox																		1		3	
48.	*Camptonectes* (*Camptonectes*) cf. *indicus* Cox										2											

TABLE I (*continued*)

S. No.	Species	Bed Nos.	16		14		13		11		7		5		4		3		2		1	
			C	E	C	F	C	E	C	E	C	E	C	E	C	E	C	E	C	E	C	E
49.	*Camptonectes* (*Camptonectes*) *srivastavai* sp. nov.																		2			
50.	*Chlamys* (*Chlamys*) *ambigua* (Münster)																				1	
51.	*Chlamys* (*Chlamys*) cf. *subarticulatus* (d'Orb.) ..																					1
52.	*Chlamys* (*Chlamys*) *subtextoria* (Münster)																		1		4	5
53.	*Chlamys* (*Chlamys*) sp. A ..												1									
54.	*Chlamys* (*Chlamys*) sp. B ..														1							
55.	*Chlamys* (*Chlamys*) *curvivarians* Dietrich										3	1	2	2								
56.	*Chlamys* (*Chlamys*) *rajnathi* sp. nov.																				2	
57.	*Chlamys* (*Chlamys*) *chiplonkari* sp. nov.										1											
58.	*Chlamys* (*Radulopecten*) sp.																1					
59.	*Spondylopecten*? *badiensis* Cox																					
60.	*Spondylopecten sahnii* sp. nov.																				1	
61.	*Eopecten aubryi* (Douvillé)						1		1		3	1									2	
62.	*Eopecten* sp.																				4	1
63.	*Placunopsis* (?) *radiata* (Phillips)																		1			
64.	*Ctenostreon proboscideum* (J. Sow.)																				2	
65.	*Limatula jaini* sp. nov. (in Singh MS)																		1			
66.	*Plagiostoma strigillata* Laube																				1	
67.	*Plagiostoma singhi* sp. nov.																				1	1
68.	*Plagiostoma aciculata* (Münster)																		1		8	1
69.	*Plagiostoma* sp.											1										
70.	*Plagiostoma saxenai* sp. nov.																		1			
71.	*Plagiostoma kackeri* sp. nov.																				1	1
72.	*Plagiostoma laxmani* sp. nov.																		1		2	
73.	*Plagiostoma jumarensis* Cox																				1	1
74.	*Pseudolimea duplicata* (J. de C. Sow.)											1		1					9		1	
75.	*Pseudolimea kanjilali* sp. nov.										1				1							

TABLE I (*continued*)

S. No.	Species	Bed Nos.	16		14		13		11		7		5		4		3		2		1	
			C	E	C	E	C	E	C	E	C	E	C	E	C	E	C	E	C	E	C	E
76.	*Gryphaea* (*Bilobissa*) *rathodi* sp. nov (in Singh MS) ..																					1
77.	*Catinula stoliczkai* Cox ..													1								1
78.	*Catinula sandalina* (Goldfuss)											1										
79.	*Catinula alimena* (d'Orb.) ..																				3	2
80.	*Nanogyra nana* (J. Sow.) ..										1		1	1							1	
81.	*Lopha* (*Actinostreon*) *gregarea* (J. Sow.)						1														2	1
82.	*Lopha* (*Actinostreon*) *marshii* (J. Sow.)						1														3	1
83.	*Lopha* (*Actinostreon*) sp. ..																				2	
84.	*Rastellum* (*Arctostrea*) *eruca* (Defrance)										1		4	2								
85.	*Trigonia* (*Trigonia*) *haboensis* Agrawal										10		8	4					1		3	
86.	*Trigonia* (*Trigonia*) *haboensis* subsp *narayani* subsp. nov.										1		1									
87.	*Trigonia* (*Trigonia*) *distincta* Kitchin												1	4	1				1			
88.	*Trigonia* (*Trigonia*) *nitida* Kitchin										1		1									
89.	*Trigonia* (*Trigonia*) *brevicostata* Kitchin						3				4	9	10	21	1							
90.	*Trigonia* (*Trigonia*) *dhosaensis* Kitchin											1										
91.	*Mesolinga agrawali* sp. nov. (in Singh MS)																		4	1		1
92.	*Mactromya mehrotrai* Agrawal																		5		6	1
93.	*Mactromyopsis* (*Mactromyopsis*) *raii* sp. nov.										2	1										
94.	*Astarte* (*Astarte*) *pandei* .. Agrawal																					1
95.	'*Astarte*' *deeplali* sp. nov. ..																			1		
96.	*Nicaniella* (*Nicaniella*) *extensa* (Phillips)																		2		1	
97.	*Nicaniella* (*Nicaniella*) *nummus* (Sauvage)																		1	3		
98.	*Nicaniella* (*Nicaniella*) *mehtai* sp. nov.																		1			
99.	*Nicaniella* (*Nicaniella*) *singhi* sp. nov.										1	1										

TABLE I (*continued*)

S. No.	Species	Bed Nos.	16		14		13		11		7		5		4		3		2		1	
			C	E	C	E	C	E	C	E	C	E	C	E	C	E	C	E	C	E	C	E
100.	*Neocrassina* (*Pruvostiella*) *freneixae* Agrawal ..																				2	2
101.	*Neocrassina* (*Pruvostiella*) *unilateralis* (J. de C. Sow.) ..										6		1						2			
102.	*Neocrassina* (*Pruvostiella*) *sowerbyana* (Holdhaus) ..																		1			
103.	*Neocrassina* (*Pruvostiella*) cf. *scytalis* (Holdhaus)																					1
104.	*Neocrassina* (*Pruvostiella*) *spitiensis* (stoliczka)				1														1		5	4
105.	*Neocrassina* (*Coelastarte*) cf. *rectangula* Arkell										1											
106.	*Coelopis* (*Coelopsis*) *coxi* sp. nov. (in Singh MS)																		1	1		
107.	*Protocardia* (*Protocardia*) *dyonisea* (Buvignier) ..																1		3		2	
108.	*Protocardia* (*Protocardia*) *sastry* sp. nov.																		1	1		1
109.	*Anisocardia* (*Anisocardia*) *minima* (J. Sow.)																		4			
110.	*Isocyprina* (*Isocyprina*) *cyreniformis* (Buvignier)																		2	1		
111.	*Sowerbya truncata* Lycett ..										4											
112.	*Ceratomyopsis striata* (d'Orb.)																		1			1
113.	*Ceratomyopsis basochiana* (Defrance)																		2			
114.	*Tellurimya rogeri* sp. nov. ..										2						1					
115.	*Tellurimya* sp.										1						1					
116.	*'Corbula'* aff. *daghaniensis* Cox										1											
117.	*Pholadomya* (*Pholadomya*) *ovalis* Roemer																		1		4	
118.	*Pholadomya* (*Pholadomya*) sp.																		1			
119.	*Pholadomya* (*Bucardiomya*) *lirata* (J. Sow.)								1	1	12				4		4		78	30	5	13
120.	*Pholadomya* (*Bucardiomya*) cf. *lirata* (J. Sow.)																				1	2
121.	*Pholadomya* (*Bucardiomya*) *protei* (Brongniart)																		2		2	
122.	*Goniomya* (*Goniomya*) *literata* J. Sow.																		2		4	

TABLE I (*continued*)

S. No.	Species	Bed Nos.	16		14		13		11		7		5		4		3		2		1	
			C	E	C	E	C	E	C	E	C	E	C	E	C	E	C	E	C	E	C	E
123.	*Goniomya* (*Goniomya*) *normaniana* (d'Orb.)																		1			
124.	*Pachymya* (*Arcomya*) *mithali* sp. nov.										1								2	1		
125.	*Homomya krishnakanti* sp. nov.										2	1										
126.	*Ceratomya* sp.										1	1										
127.	*Pleuromya alduini* (Brongniart)																				1	
128.	*Pleuromya uniformis* (J. Sow.																		43		23	10
129.	*Pleuromya calceiformis* (Phillips)																		1			
130.	*Thracia* (*Thracia*) *greppini* Cossmann																		3			

TABLE II

Distribution of the ammonoids

S. No.	Species	Bed Nos.	12		7		5		4		3		2		1	
			C	E	C	E	C	E	C	E	C	E	C	E	C	E
1.	*Phylloceras* sp.														1	
2.	*Ptychophylloceras jaraense* (Waagen)														1	
3.	*Ptychophylloceras insulare* (Waagen)														4	1
4.	*Ptychophylloceras feddeni* (Waagen)															1
5.	*Ptychophylloceras* cf. *ptychoicum* (Quenstedt) ..															1
6.	*Calliphylloceras lodaense* (Waagen)												1			4
7.	*Calliphylloceras* aff. *benacense* (Catullo).. ..												1			
8.	*Calliphylloceras* sp.														1	2
9.	*Calliphylloceras* sp. ind.															1
10.	*Holcophylloceras* cf. *mediterraneum* (Neumayr)														2	
11.	*Lissoceras* (*Lissocratoides*) sp. juv.															2
12.	*Oecotraustes* (*Paroecotraustes*) sp. nov.												2	2		
13.	*Oppelia* (? *Oxycerites*) sp. ind.												1			
14.	*Paralcidia glabella* (Bean MS) Leckenby ..												4	2		
15.	*Paralcidia* sp. juv.												1	2		
16.	*Hecticoceras* (*Kheraites*) *ferrugineus* Spath ..													1		
17.	*Hecticoceras* (*Brightia*) sp. nov.												1	2	2	1
18.	*Hecticoceras* (*Sublunuloceras*) *lairense* (Waagen)												7	1	3	1

TABLE II *continued*)

S. No.	Species	Bed Nos.	12		7		5		4		3		2		1	
			C	E	C	E	C	E	C	E	C	E	C	E	C	E
19.	*Hecticoceras* (*Sublunuloceras*) *lairense* (Waagen) subsp. *magnumbilicum* subsp. nov. (in Singh (MS)												5			2
20.	*Hecticoceras* (*Sublunuloceras*) *dynastes* (Waagen)												1		1	
21.	*Hecticoceras* (*Sublunuloceras*) cf. *prelairense* Spath														1	
22.	*Hecticoceras* (*Sublunuloceras*) *discoides* Spath ..													1		
23.	*Hecticoceras* (*Sublunuloceras*) ? cf. *inermis* (Douvillè)													1		
24.	*Hecticoceras* (*Sublunuloceras*) sp.															1
25.	*Hecticoceras* (*Pseudobrightia*) *dhosaensis* Spath														1	
26.	*Hecticoceras* (*Pseudobrightia*) *subpunctata* (Spath)															2
27.	*Hecticoceras* (*Pseudobrightia*) sp.															1
28.	*Hecticoceras* (*Putealiceras*) *intermedium* Spath												2		1	
29.	*Hecticoceras* (*Putealiceras*) *trilineatum* (Waagen)												4			
30.	*Hecticoceras* (*Putealiceras*) *vijaya* Spath ..												1			
31.	*Hecticoceras* (? *Eochetoceras*) sp. ind.															1
32.	*Ochetoceras* (*Neocampylites*) *secula* (Bean MS) (Spath)															3
33.	*Taramelliceras* (*Taramelliceras*) sp. juv. ..															1
34.	*Taramelliceras* (*Proscaphites*) *hermonis* (Noetling)														1	
35.	*Subbonarellia decipiens* Spath												2			
36.	*Subbonarellia* cf. *manialensis* Spath										1					
37.	*Sindeites* aff. *sindensis* Spath		1													
38.	*Pachyceras* sp. nov.												1			
39.	*Paryphoceras badiense* Spath														1	
40.	*Paryphoceras rugosum* Spath															1
41.	*Mayaites* (*Mayaites*) *maya* (J. de C. Sow.) ..														6	3
42.	*Mayaites* (*Mayaites*) aff. *maya* (J. de C. Sow.)														1	
43.	*Mayaites* (*Mayaites*) cf. *smeei* Spath														2	
44.	*Mayaites* (*Mayaites*) *rotundus* Spath															2
45.	*Mayaites* (*Mayaites*) *jumarensis* Spath															2
46.	*Mayaites* (*Mayaites*) sp.															3
47.	*Mayaites* (*Epimayaites*) sp. juv.														3	2
48.	*Dhosaites elephantoides* Spath														2	1
49.	*Dhosaites* aff. *elephantoides* Spath														1	
50.	*Dhosaites* cf. *elephantoides* Spath														1	2
51.	*Dhosaites otoitoides* Spath															1

TABLE II (*continued*)

S. No.	Species	Bed Nos.	12		7		5		4		3		2		1	
			C	E	C	E	C	E	C	E	C	E	C	E	C	E
52.	*Dhosaites primus* Spath	.. ..													1	
53.	*Dhosaites* sp.	.. ..													1	
54.	*Reineckeia* ? (*Reineckeia*) sp.	.. ..			1											
55.	*Reineckeia* (*Reineckeites*) *waageni* (Till)	..									1		2	1		
56.	*Collotia* sp.	.. ..													1	
57.	*Hubertoceras* aff. *hubertus* Spath	.. ..											1			1
58.	*Hubertoceras* sp. nov.	.. ..											2			1
59.	*Hubertoceras* sp.	.. ..									1					
60.	*Hubertoceras omphalodes* (Waagen)	.. ..											1			
61.	*Hubertoceras* aff. *dhosaense* (Waagen)	.. ..					1									
62.	*Obtusicostites obtusicosta* (Waagen)	.. ..			1								1			
63.	*Obtusicostites* sp.	.. ..											1			
64.	*Obtusicostites buckmani* Spath	.. ..											1			
65.	*Obtusicostites* aff. *ushas* Spath	.. ..											1			
66.	*Obtusicostites* sp. ind.	.. ..											1	1		
67.	*Kinkeliniceras angygaster* (Waagen)	.. ..											1			
68.	*Kinkeliniceras* cf. *kinekelini* (Dacqué)	.. ..									1					
69.	*Kinkeliniceras* sp. ind.	.. ..											1			
70.	*Kinkeliniceras* sp. A	.. ..											1			
71.	*Kinkeliniceras* sp. B	.. ..							1							
72.	*Sivajiceras* sp.	.. ..	1													
73.	*Grossouvria* sp.	.. ..									1		1			
74.	*Grossouvria* (*Klematosphinctes*) *praecursor* (Waagen)	.. ..														1
75.	*Subgrossouvria gudjinsirensis* (Waagen)	.. ..							1							
76.	*Poculisphintes* ? sp. ind.	.. ..													1	
77.	*Binatisphinctes* sp. juv.	.. ..											1			
78.	*Orionoides* cf. *purpurus* Spath	.. ..			1											
79.	*Alligaticeras polymorphum* Spath	.. ..													1	
80.	*Alligaticeras* aff. *polymorphum* Spath	.. ..														1
81.	*Alligaticeras joorense* (Waagen)	.. ..													1	1
82.	*Alligaticeras* sp. juv.	.. ..											2			
83.	*Properisphinctes bernensis* (P. de Loriol)	..													2	3
84.	*Properisphinctes* cf. *virguloides* (Waagen)	..														1
85.	*Perisphinctes* (*Perisphinctes*) *indogermanus* (Waagen)															2
86.	*Perisphinctes* (*Orthosphinctes*) *anguinus* (Spath)														1	

TABLE II (*continued*)

S. No.	Species	Bed Nos.	12		7		5		4		3		2		1	
			C	E	C	E	C	E	C	E	C	E	C	E	C	E
87.	*Perisphinctes* (*Dichotomosphinctes*) *jacki* (Spath)														2	2
88.	*Perisphinctes* (*Kranaosphinctes*) *subevolutus* (Waagen)														2	
89.	*Perisphinctes* (*Kranaosphinctes*) *nerunaensis* (Spath)															1
90.	*Perisphinctes* (*Kranaosphinctes*) cf. *irregularis* (Spath)															1
91.	*Peltoceras* (*Peltoceras*) *ponderosum* (Waagen)														1	
92.	*Peltoceras* (*Peltoceras*) sp. ind.														2	
93.	*Peltoceras* (*Peltoceras*) sp.														1	
94.	? *Peltoceras* sp. ind.												1			
95.	*Peltoceras* (*Metapeltoceras*) aff. *diversiforme* (Waagen)														1	
96.	*Parawedekindia* aff. *torosus* (Oppel)														1	
97.	*Parawedekindia* sp.															1
98.	*Euaspidoceras* (*Euaspidoceras*) *waageni* Spath ..														2	
99.	*Euaspidoceras* (*Euaspidoceras*) aff. *simile* Spath														1	
100.	*Euaspidoceras* (*Euaspidoceras*) sp. nov.														1	
101.	*Euaspidoceras* (*Euaspidoceras*) *badiense* Spath ..															1
102.	*Euaspidoceras* (*Euaspidoceras*) sp. juv. ind. ..															2
103.	*Euaspidoceras* (*Epaspidoceras*) ? *subdistructum* (Waagen)															1
104.	*Euaspidoceras* (*Paraspidoceras*) sp. iuv. ind. ..															1

of specimens belonging to each species collected from respective bed(s). Alphabets 'C' and 'E' stand for Central and Eastern Units.

CORRELATION OF BEDS

It would not be out of place to recall that Blake seems to have subdivided the "Chari" sequence on the east of Ler into ten beds which were numbered in ascending order, i.e., successively higher numbers were assigned to younger beds. Their succession given by Spath (1924, pp. 24–25) on the basis of the ammonoids in his collection is incomplete. The section published by Smith (1914, p. 177), on the other hand, is hypothetical and it is not described precisely. To quote Spath (1933, p. 750) it is "diagrammatic and the exact beds of the numerous ammonites then recorded, unfortunately, have not been noted." He, too, has reproduced the same but not discussed it (*op. cit.*, fig. 6). Evidently, both these successions are not helpful for correlation purposes. Besides, the use of sub-divisions such as "*athleta, anceps, rehmanni* and *macrocephalus* beds," established by Spath for the part of Habo Series lying below the Mebha Oolite, in the following pages is in local stratigraphical sense only.

However, an attempt has been made here to place the beds of Blake and Smith in proper order *vis-á-vis* the Spath's zones on the basis of their ammonoids as identified by Spath and their ranges given by him in Table IV (See p. 144) (Spath, 1933, pp. 706 *et seq.*). Subsequently, their correspondence with those of the present authors (Agrawal & Kachhara, *op. cit.*, Table I) will be examined and these in turn will be correlated with the Habo beds of certain areas of the Kutch Mainland (for localities see Rajnath, 1932, Pl. XII or Agrawal, 1958, Fig. 1).

Local succession

Blake's succession — Blake's *"Nucula flags"* have yielded solitary example of *Choffatia lateralis* belonging to Rehmanni Zone and Anceps Beds of Spath. The ammonites picked up, perhaps loose, *"in stream"* have been identified as *Sublunuloceras prelairense* and *Hubertoceras mutans*, both of which are of Anceps assemblage and the latter is common in these beds (Spath, 1933, p. 720–21, Table IV). Bed No. 6 contains an immature *Grossouvria* in addition to *"Chlamys (Spondylopecten) badiensis"* and *"Liostrea (Catinula) alimena"*. None of these is restricted to any one horizon in Kutch; the species of *Grossouvria* have been reported both from Anceps and Athleta Beds. The lone ammonite (No. 492, Blake Coll.) recorded from the overlying Bed No. 7 is "indistinguishable" from the young of *Sivajiceras paramorphum* which species according to Spath (*loc. cit.*) is common in Rehmanni Zone.

Hence, Blake's beds referred to above can conveniently be included in the group of Rehmanni-Anceps Beds of Spath, better Reineckeia Beds since it is not always possible to draw a definite line between them. Spath himself, at times, has preferred the use of the latter term. Both Agrawal (1956, 1958) and Singh (1961) are also in favour of calling them as Reineckeia Beds. Arkell (in R.C. Moore, 1957, p. L294 and 312), too, seems to be in favour of one term only by restricting the occurrence of *Reineckeia* together with "the special Kutch group of *Subkossmatia* and *Idiocycloceras"* in Anceps Zone. The latter two genera are typical of Rehmanni Zone of Spath (*op. cit.*, pp. 716–17 and 766).

The next higher bed in the succession, No. 8, has yielded *Sublunuloceras lairense* and an immature *Collotia* of *fraasi* group. The former species is common in Athleta Beds, chiefly lower, although in the present collection four specimens have been obtained from Mebha Oolite as well, whereas the latter one is a "unique" form (Spath, *op. cit.*, pp. 718–19) of Lower Athleta Beds. Cox (1940, pp. 40, 50 and 73) also has assigned *Parallelodon lerensis* (only holotype), *Grammatodon (Indogrammatodon) virgatus*, and *Modiolus (Inoperna) plicatus*, collected from this horizon, to *"athleta* beds (Divesian)".

From Bed No. 10 have been recorded *Paryphoceras rugosum*, *"Otosphinctes rota"*, *Otosphinctes rotiformis*, and *Euaspidoceras waageni*. This assemblage is of Lower Mebha Oolite of Spath.

The label on Blake's specimen No. 497 seems to read "above 10" (Spath 1931, p. 573). This "unique" example of *Pseudopeltoceras retrorsum* has been referred to "upper anceps beds" by Spath (1933, pp. 732–33) because of its matrix. But in view of the numbering of beds done by Blake, this horizon is to be considered

younger than his Bed No. 10 ("Dhosa Oolite"). The occurrence of the said ammonoid is, therefore, unusual unless it was picked up loose.

Smith's succession — The four-fold division of the Habo beds to the east of Ler village introduced by Smith is (in ascending order): *Sub-anceps* bed 1, *Anceps* beds, *Athleta* beds, and "Dhosa Oolite". This is hypothetical to a great extent. In numerous instances, as mentioned earlier, the ammonoids collected by him did not have exact reference to the beds from which they were obtained. To correlate broadly, however, "Dhosa Oolite" apparently corresponds to Mebha Oolite, whereas "*athleta*" and "*anceps*" beds to Spath's beds with same names, and "*sub-anceps* beds" of the area (Ler-Katrol ellipse) to those of "Fakirwadi", "Walakhavas", and of the adjacent "Ler-Hamundra ellipse". The occurrence of *Subkossmatia, Idiocycloceras* prompted Spath (1933, pp. 752, 766) to refer these oldest beds of the last two areas to Rehmanni Zone. Hence, Smith's sub-*anceps* beds of the section under consideration may not be of earlier date than this zone.

Present authors' succession — As regards the present authors' succession, the faunal evidences are very inadequate for proper correlation. The reliable evidence of ammonoids is not available from many beds, especially those older than Bed No. 12. Consequently, the precise correspondence of the Habo beds on the east of Ler to those of other areas in Kutch as well as Spath's zones cannot be established.

The lowest bed (No. 17) is unfossiliferous. It is difficult to assign it a precise age. *Palaeonucula cuneiformis* only has been recorded here from Bed Nos. 16 and 14 but the planes of laminae of the constituent siltstone are studded with nuculids which are generally unidentifiable. At no other horizon in the sequence, nuculids occur in such a manner and abundance. These two beds may, therefore, be equated with Blake's "*Nucula flags*" of east of Ler.

The bivalve species of Bed No. 13 are long-ranging and hence, not useful for correlation. Bed No. 12 has yielded a specimen each of *Sindeites* aff. *sindensis* and *Sivajiceras* sp. The former species is confined to Lower Anceps Beds, whereas all the forms belonging to *Sivajiceras,* with the exception of its type species, which have been described by Spath belong to Rehmanni and/or Anceps Beds. Blake's Bed No. 7 also contained an immature *Sivajiceras paramorphum.* These two beds, therefore, may be thought to correspond very broadly.

From the next ammonite-yielding bed, No. 7, a typical individual of *Obtusicostites obtusicosta* and an indeterminate example of *Kinkeliniceras* in addition to a specimen doubtfully referred to *Reineckeia* have been obtained. The first of these is common in Anceps Beds. Also, all but one species of *Kinkeliniceras* belong to these beds, mostly upper. Further, the record of a representative each of *O. obtusicosta* and *Kinkeliniceras* sp. indet. from Bed No. 2 need not be surprising since certain species of the former genus and *K. catillus* are already known to be restricted, some even common, to Lower Athleta Beds. Moreover, the bed under discussion has yielded specimens of Callovian bivalve genera *Sowerbya* and *Tellurimya.*

The next higher fossiliferous beds, Nos. 5 and 4, have yielded *Hubertoceras* aff. *dhosaense,* and *Kinkeliniceras* sp. B and *Subgrossouvria gudjinsirensis* respectively. All of them are of "*anceps* assemblage" of Spath. The overlying Bed No. 3 contains *Reineckeia* (*Reineckeites*) *waageni,* a common form of Upper Anceps Beds, and *Kinkeliniceras* cf. *kinkelini* which species also Spath places in his "*anceps* assem-

blage". It is, therefore, to be referred unhesitatingly to Anceps Beds. In doing so the record of the former species from the present Bed No. 2 need not be surprising as "*Reineckeites* of the *multicostata* type" and some other species of "*anceps* assemblage" have been obtained from Rajnath's Bed No. 2 of Jumara and Nara domes, which Spath has preferred to group in Athleta Zone. Also, the occurrence of *Hubertoceras* and *Grossouvria* in this bed is not conflicting since the two genera are found both in Anceps and Athleta Beds. Much significance, however, cannot be attached to the lone specimen (No. L/36/8, Univ. of Rajasthan Coll.) collected from this bed and identified as *Subbonarellia* cf. *manialensis*, a Lower Athleta form, because of its poor preservation.

In view of what has been said above the Bed Nos. 3 to 16, and perhaps even No. 17, can be referred to Reineckeia Beds. Their age is certainly Callovian.

Bed No. 2 has yielded *Hecticoceras* (*Sublunuloceras*) *lairense*, *Hecticoceras* (*Sublunuloceras*) *dynastes*, *Hecticoceras* (*Putealiceras*) *intermedium*, *Hecticoceras* (*Putealiceras*) *trilineatum*, *Pachyceras* sp. nov., *Hubertoceras* aff. *hubertus*, *Hubertoceras omphalodes*, *Obtusicostites* aff. *ushas*, and a young of *Binatisphinctes*. All of them, according to Spath (1933, Table IV), are confined to Athleta Beds; of course, the present writers have now reported the first three species together with *Hubertoceras* aff. *hubertus* from Bed No. 1 as well. Also, *Nuculana* (*Rollieria*) cf. *meriani* is recorded by Cox (1940, p. 36) only from "Divesian, *athleta* beds". The above assemblage, on the whole, suggests that the Bed No. 2 may be referred to Athleta Beds of Spath.

Besides, from this horizon have been obtained some forms of Anceps Beds such as (*Kinkeliniceras angygaster*, *Hecticoceras* (*Kheraites*) *ferrugineus*, *Obtusicostites buckmani*, *Obtusicostites obtusicosta*, *Subbonarellia decipiens*, and *Reineckeia* (*Reineckeites*) *waageni*. Their occurrence need not be considered abnormal since certain species characteristic of "*anceps* assemblage" are already known from Athleta Beds of other areas in Kutch; for instance, *Orionoides purpurus*, "*Reineckeites* of the *multicostata* type" from Rajnath's Bed Nos. 2 and 3 of Jumara dome; *Choffatia simulans* from Rajnath's Bed No. 2 of Nara dome; a variety of *Kinkeliniceras kinkelini* from Bed No. 2 of exposure A and an indeterminate fragment of *Kinkeliniceras* from Bed No. 2 of exposure F of Fakirwari-Walakhawas Tank area (Singh, 1961).

Further, it has to be added that the occurrence of *Subbonarellia decipiens* (Bed No. 2), referred to above, and *Subbonarellia* cf. *manialensis* (Bed No. 3) is in an inverse order because the former is an "upper *anceps*" form and the latter a "lower *athleta*" species whereas Bed No. 2 is younger than Bed No. 3. Another good instance of similar nature, already pointed out earlier (Agrawal, 1958, p. 128), is the record of *Choffatia simulans* and *Orionoides purpurus* from Rajnath's Bed Nos. 2 and 3 of Nara dome respectively. The present writers, therefore, as stated elsewhere (Agrawal, *op. cit.*) feel that "*the fine subdivision of the Kutch formations which Spath wishes to establish is not practicable*".

So far as the age is concerned, there is diversity of opinion. Spath (1933) and Cox (1940; 1952) included Athleta Beds in Divesian, Rajnath (1942) and Arkell (1956) in Callovian, Agrawal (1956; 1958) and Singh (1961) in Callovo-Oxfordian. However, the present authors are inclined to assign the present Bed No. 2 to Callovian

owing to *Reineckeia* (*Reineckeites*), *Obtusicostites, Kinkeliniceras, Hubertoceras* and *Binatisphinctes,* all Callovian genera, found in it.

The topmost bed of the succession, No. 1, has very characteristic lithology and it cannot be missed. It has yielded the examples of subgenus/genera such as *Pseudobrightia, Paryphoceras, Mayaites,* and *Dhosaites* together with species such as *Ptychophylloceras jaraense, Ochetoceras* (*Neocampylites*) *sicula, Grossouvria* (*Klematosphinctes*) *praecursor, Perisphinctes* (*Dichotomosphinctes*) *jacki, Perisphinctes* (*Kranaosphinctes*) *nerunaensis, Parawedekindia* aff. *torosus, Euaspidoceras* (*Euaspidoceras*) *waageni,* and *Euaspidoceras* (*Euaspidoceras*) *badiense.* This is characteristic assemblage of Lower Mebha Oolite of Spath, to which the bed in question may be considered to correspond broadly. Further, among the many bivalve species found in this bed are *Trichites* cf. *gemmellaroi, Oxytoma* (*Oxytoma*) *inequivalvis,* and *Plagiostoma strigillata* which in Kutch are not so far recorded from horizons earlier than Mebha Oolite.

Moreover, the present authors have now reported, in addition to a few forms of older assemblage, certain species of higher horizons from the bed under discussion, viz., *Ptychophylloceras insulare, Prososphinctes* cf. *virguloides, Perisphinctes* (*Kranaosphinctes*) cf. *irregularis* and an immature example of *Taramelliceras* which genus is common in Katrols; the former two species are considered to be restricted to Kantkote Sandstone whereas the third one to Katrols by Spath. The occurrence of these forms in Bed No. 1 is perhaps incidental and exceptional or it may be a case of the extension of their vertical ranges.

Spath (1933, p. 782) while suggesting two distinct assemblages in Lower Mebha Oolite, maintained that the upper one with *Paryphoceras* roughly corresponding to "upper *cordatus* zone" is missing from the exposures of Habo beds on the south of Bhuj. But, as already pointed out by one of the present authors (Agrawal, 1958, p. 129), *"it is the reverse which is correct."* Spath himself has recorded an example (No. 283) of *Paryphoceras rugosum* from Blake's Bed No. 10 of east of Ler and now the present authors have reported a specimen each of *Paryphoceras rugosum* and *P. badiense* from the area.

For assigning an age to Mebha Oolite, it has to be borne in mind that the Bed No. 1 contains a mixture of heterochronous elements. On the one hand there are Oxfordian genera such as *Pseudobrightia, Paryphoceras, Mayaites, Dhosaites,* and *Properisphinctes,* etc. and, on the other, the Callovian genera, viz., *Collotia* and *Hubertoceras,* together with *Holcophylloceras* cf. *mediterraneum* in addition to genera like *Sublunuloceras, Alligaticeras,* and *Euaspidoceras,* which three are encountered both in Callovian and Oxfordian. Contextually, it may be recalled that Bed No. 1 of Jhura dome has already yielded a good specimen of *Dolikehalites subcompressus* which is of Callovian age (Agrawal, 1956, p. 168–69). Evidently, the Bed No. 1 of the present authors' succession is to be considered as Callovo-Oxfordian, which is in conformity with the conclusion arrived at by Agrawal (*op. cit.*) and Singh (1961, p. 231) for the bed with the same number and identical lithology, of the Jhura dome and the various exposures of Fakirwari-Walakhawas Tank area, respectively. Presumably the boundary between the Callovian and the Oxfordian lies somewhere in Bed No. 1.

The results of the above discussion are summarized in Table III.

TABLE III

Correlation of local succession with Spaths' zones

Agrawal & Kachhara (E. of Ler)		Blake (E. of Ler)	Smith (E. of Ler)	Spath (Kutch)		
		Above 10 ?				Argovian-Upper Divesian
Callovo-Oxfordian	Bed No. 1	Bed No. 10	"Dhosa" oolite	"Dhosa" (=Mebha) Oolite		Argovian-Upper Divesian
Collovian	Bed No. 2	Bed No. 8	*"Athleta"* beds	*"athleta beds"*		Lower Divesian
Callovian	Bed Nos. 3–13	Bed Nos. 6 & 7	*"Anceps"* beds	*"anceps* beds	*"Reineckeia beds"*	Callovian
	Bed Nos. 14–16	*"Nucula* flags"				
	Bed No. 17		*"Sub-anceps"* beds	*"rehmanni* zone"		

Correlation with other sections

Fakirwari-Walakhawas Tank area — In this area on the south of Bhuj there are in all nine exposures, denoted as from A to I and described by Singh (1961). His collection was poor in ammonoids and also, several sections are very thin. Consequently, comparison of the East Ler sequence with any one of them is not possible to the extent desired; only the exposure G stands somewhat in good stead. According to him (*op. cit.*, p. 230) "the Macrocephalus Beds are missing.....(and) the oldest beds exposed are the Reineckeia Beds" in that area. In the area under investigation, too, no macrocephalitid has been obtained and the Macrocephalus Beds, if at all they exist below, do not come to the surface. The lowest beds exposed are most probably not of earlier date than Reineckeia Beds.

Bed No. 4 of the exposure G contained *Reineckeia* sp. and *Obtusicostites buckmani* of "*anceps* assemblage". Neither the younger Bed, No. 3, nor the older beds, Nos. 5–8, all included in "Reineckeia Beds" by Singh, yielded to him any ammonoid. In East Ler Bed No. 7 also are found *Reineckeia* sp. and *Obtusicostites obtusicosta*, common in Anceps Beds in wider sense, and the younger beds, Nos 5, 4 and 3, have yielded *Hubertoceras* aff. *dhosaense*, *Kinkeliniceras*, and *Reineckeia* (*Reineckeites*) *waageni* respectively. Additional mention may be made of bivalve species such as *Palaeonucula cuneiformis*, *P. blanfordi*, *Grammatodon* (*Indogrammatodon*) *jurianus*, *G.* (*I.*) *virgatus*, *Modiolus* (*Modiolus*) *agrawali*, *Lopha* (*Actinostreon*) *gregarea*, and *Protocardia* (*Protocardia*) *dyonisea* in Bed Nos. 4 or/and 7 and 8 of exposure G and in one or the other/more of the East Ler Bed Nos. 3, 4, 5, 7, 11, and 13. Thus, the broad correspondence of Bed Nos. 3 to 8 of exposure G with East Ler Bed Nos. 3 to 17 is evident.

Likewise, Bed No. 6 of the exposure A has yielded *Reineckeia* and *Sivajiceras*, and hence may be put in the group of Ler Bed Nos. 7 and 12.

Next above, comes Bed No. 2. In view of its structural position, i.e. immediately below Mebha Oolite, and the common occurrence of *Coelopis* (*Coelopis*) *coxi*, *Hecticoceras* (*Putealiceras*) *trilineatum*, *H.* (*P.*) *intermedium*, *H.* (*Sublunuloceras*) *lairense*, and *Hubertoceras hubertus*, the Bed No. 2 of the study-area and that of the exposure G can be correlated.

Further, in view of the lithology and the fauna, on the whole, the present Bed No. 1 may be taken to correspond to that of the various exposures of Fakirwari-Walakhawas Tank area. The suggestive forms are *Mayaites* (*Mayaites*) *maya*, *M.* (*M.*) *rotundus*, *Properisphinctes bernensis* together with bivalve species such as *Oxytoma* (*Oxytoma*) *inequivalvis*, *Plagiostoma strigillata*, *Neocrassina* (*Pruvostiella*) *freneixae*, and *Gryphaea* (*Bilobissa*) *rathodi*. However, the striking difference is the absence of any representative of "*Dichotomosphinctes helenae*" and other characteristic species of "Upper Mebha Oolite" of Spath in the present collection; "*D. helenae*" is known from Bed No. 1 of the exposures G and H (Singh, 1961, pp. 187 and 231).

Jhura dome — The section of Habo Series in this dome worked out by Agrawal (1956) is much expanded. Several macrocephalitids have been recorded from Lower Habo Series (Bed Nos. 15 to 18) included in Macrocephalus Beds. Nothing corresponding them crops out in the area under investigation. Besides, Bed No. 16 in which the nuculids occur in abundance and cover the bedding plane, has yielded *Macrocephalites*, *Indocephalites*, and *Kamptokephalites*. This bed is, therefore, much different from Bed Nos. 14 to 16 of the present authors' succession. In other words, Blake's "*Nucula flags*" of W. Badi (Jhura dome) and E. Ler are not at the same horizon. Again, the correspondence of Jhura Bed Nos. 8 to 10 with any or some of those of Ler cannot be definitely established.

It is the overlying Bed No. 7 with *Reineckeia* (*Reineckeia*), *Reineckeia* (*Reineckeites*), *Kinkeliniceras*, *Obtusicostites* and *Hubertoceras dhosaense*, which can be taken to correspond to Bed Nos. 3 to 7 together. This correspondence may be extended down to Bed No. 13 on the strength of a specimen (No. L/27/30; Table I) comparable to *Cucullaea* (*Cucullaea*) *coxi* whose holotype, the sole representative of the species, was described from Jhura Bed No. 7 (Agrawal, *op. cit.*, pp. 59 and 154).

On the bases of its structural position (immediately below Bed No. 1), a specimen of *Pachyceras*, and to some extent lithology the Bed No. 2 of both the sections may be considered at par.

Bed No. 1 of Jhura dome can be easily correlated with that of the present succession in view of its characteristic lithology and the following assemblage of fossils :—

(*Ammonoids*) — *Paryphoceras rugosum*, *Mayaites* (*Mayaites*) *jumarensis*, *Perisphinctes* (*Dichotomosphinctes*) *jacki*, *P.* (*Kranaosphinctes*) *subevolutus*, *Peltoceras* (*Metapeltoceras*) aff. *diversiforme*; (*bivalves*)—*Trichites* cf. *gemmellaroi*, *Oxytoma* (*Oxytoma*) *inequivalvis*, *Astarte* (*Astarte*) *pandei* and *Neocrassina* (*Pruvostiella*) *freneixae*.

Jumara dome — The Jumara section established by Rajnath (1932 & 1942; also see Spath, 1933, p. 739) is more expanded than that of even Jhura dome. Here, too, Macrocephalus Beds have been subdivided into many beds but their equivalents on the east of Ler are missing. Therefore, the correlation of only the upper part of the section is attempted below.

From Bed No. 5 have been obtained fifteen specimens of the typical *Sindeites sindensis* and the coarser *S. waageni* (Spath, *op. cit.*, p. 669). An example of *sindensis* type has been recorded here from Bed No. 12 of Central Unit. In the overlying/underlying beds of the two areas under consideration, Jumara Bed Nos. 4 to 9 and Ler Bed Nos. 3 to 7, which have been referred to Reineckeia Beds, the typical genera such as *Reineckeia* (*Reineckeia*), *R.* (*Reineckeites*), *Kinkeliniceras* and *Sivajiceras* are common.

Higher up in the succession, Rajnath's Bed Nos. 2 and 3, and East Ler Bed No. 2 contain characteristic fossils of Athleta Beds of Spath. Further, not unlike Jumara Bed No. 2, as already mentioned, the East Ler Bed No. 2 has yielded certain forms of "*anceps* assemblage" of Spath.

Lastly, the "Lower Dhosa Oolite" (Rajnath's Bed No. 1, *pars*) is identical to Ler Bed No. 1 in its lithology. Common elements such as *Mayaites* (*Mayaites*) and *Euaspidoceras* confirm their correlation in a broad manner. Besides, it may be repeated that none of the characteristic species of "Upper Mebha Oolite" of Spath (*op. cit.*, p. 783) has been obtained from east of Ler although a few forms of still higher horizons have been reported.

The conclusions of the foregoing review are summaried in Table IV.

TABLE IV

Correlation of local succession with other sections in Kutch

E. of Ler (Agrawal & Kachhara)		Fakirwari—Walakhawas Tank area (Singh, 1961)	Jhura dome (Agrawal, 1956)	Jumara (Rajnath's beds, Spath, 1933)	
Mebha Colite	Bed No. 1	(Bed No. 1 (Mebha Oolite))	(Mebha Oolite (Bed No. 1))	Bed No. 1 (pars)	
"*Athleta*" beds	Bed No 2	Bed No. 2	Bed No. 2 Bed Nos. 3–6	Bed Nos. 1(Pars) — 3	
	Bed Nos. 3–13	Bed Nos. 3 & older beds	Bed Nos. 7–11	Bed Nos. 4–9	"*Reineckeia* beds"
"*Reineckeia*" beds	Bed Nos. 14-15 (=Blake's *Nucula* flags of E. Ler) Bed No. 17			Bed Nos. 10 & 11?	
(Base not exposed)		(Base not exposed)	Bed Nos. 12–14 Bed No. 16 (=Blake's *Nucula* flags of Badi) Bed Nos. 17–18 (Base not exposed)	Bed No. 12 and older Habo beds	"*Macrocephalus* beds"

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