

Ammonoid biostratigraphy in the Tithonian (Late Jurassic) of Jaisalmer, western India

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Pandey, B & Krishna Jai 2002. Ammonoid biostratigraphy in the Tithonian (Late Jurassic) of Jaisalmer, western India. *Geophytology* 30(1&2): 17-25.

The present paper incorporates recent progress made in the ammonoid biostratigraphy of Tithonian, Jaisalmer (western India). The Tithonian sedimentary succession in Jaisalmer mainly includes Rupsi Member and Bhadasar Member of the Bhadasar Formation, while the youngest Mokal Member of the Bhadasar Formation (devoid of ammonoids) probably extends into Early Cretaceous. The study is based on precise bed by bed ammonoid collections, their taxonomic differentiation and biostratigraphic evaluation. The generic/ species range allow the evaluation of the Tithonian ammonoid succession of Jaisalmer with reference to the Indo–East-African standard scheme of Kachchh and European standard Tethyan scheme. The Indian basal Tithonian Pottingeri Zone (= European Tethyan Hybonotum Zone) is not found in Jaisalmer; a new zone (*Natricoides* Zone) is introduced in the Early Tithonian. The Kachchh *Communis* Zone, earlier considered as the oldest zone of Late Tithonian, is now included in the Early Tithonian as its youngest zone. In all 4 zones and 8 subzones/ horizons are recognized in the Tithonian of Jaisalmer. The Indian Tithonian ammonoid zonation is nearly complete with improved correlations with the Tethyan standard zonation scheme of Europe.

Key-words – Tithonian, Ammonoid, Biostratigraphy, Late Jurassic, Jaisalmer Basin.

INTRODUCTION

THE Jaisalmer Basin of Rajasthan in the western sector of the Indian plate exposes substantive marine Mesozoic sedimentary succession (Fig. 1). The oldest ammonoid level in the basin is assigned to Late Bathonian age (Krishna & Westermann, 1985) while the youngest ammonoid level is late Early to early Middle Albian (Krishna 1980, 1987). Pandey and Fürsich (1994) studied the corals from Jaisalmer and assigned Bajocian age to the earliest exposed marine sediments in the basin. The Jurassic succession in the basin includes a fairly rich assemblage of mega invertebrates, in particular the ammonoids which are stratigraphically very significant in context of high resolution stratigraphy and long distance correlation. In addition to ammonoids, the other fossils present are bivalves, brachiopods, gastropods, foraminifera, echinoids, corals, belemnites, etc. The stratigraphic significance and age assignment of ammonoid rich Tithonian sedimentary succession of Jaisalmer has been brought out in our earlier preliminary reports (Krishna *et al.* 1966a, Pandey & Krishna 1996).

PREVIOUS WORK

Four Late Jurassic ammonoid specimens are referred in Oldham (1886) from Jaisalmer. Three of them were later determined as *Virgatospinectes* (Spath 1933, Pascoe

1959) and assigned to Tithonian age. Dasgupta (1975) mentioned the presence of *Virgatospinectes* and *Aulacospinectes* in the Tithonian sedimentary succession without illustrations and without biostratigraphic comments. Krishna (1983) named the youngest Jurassic fauna as the *Lithacoceras – Virgatospinectes* assemblage and assigned the same to Early Tithonian. Later, he (1987) proposed two successive ammonoid assemblages, viz., *Pachyspinectes* assemblage and *Virgatospinectes* assemblage, in the Tithonian of Jaisalmer Basin. Chatterjee (1990) recognised two assemblage zones in the Tithonian of Jaisalmer as *Haploceras – Aulacospinectoides* assemblage Zone and *Virgatospinectes densiplicatus* range Zone which is maintained in Dave and Chatterjee (1996). Recently Krishna *et al.* (1996a) and Pandey and Krishna (1996) have recorded *Aulacospinectoides*, *Virgatospinectes*, *Holcophyloceras*, *Haploceras*, *Hildoglochiceras*, *Aulacospinectes*, *Corongoceras* and a new genus and assigned them to Tithonian age. Krishna *et al.* (1996a) tentatively corresponded these ammonoids to the Kachchh *Virgatospinectoides* Zone – *Densiplicatus* Zone interval i.e., to Tithonian excluding its basal Pottingeri Zone. Thus, presence of the Kimmeridgian Stage in Jaisalmer (Krishna, 1987; Dave & Chatterjee, 1990; Garg *et al.*, 1998) is discounted by Krishna *et al.* (1996), which is maintained in the present work.

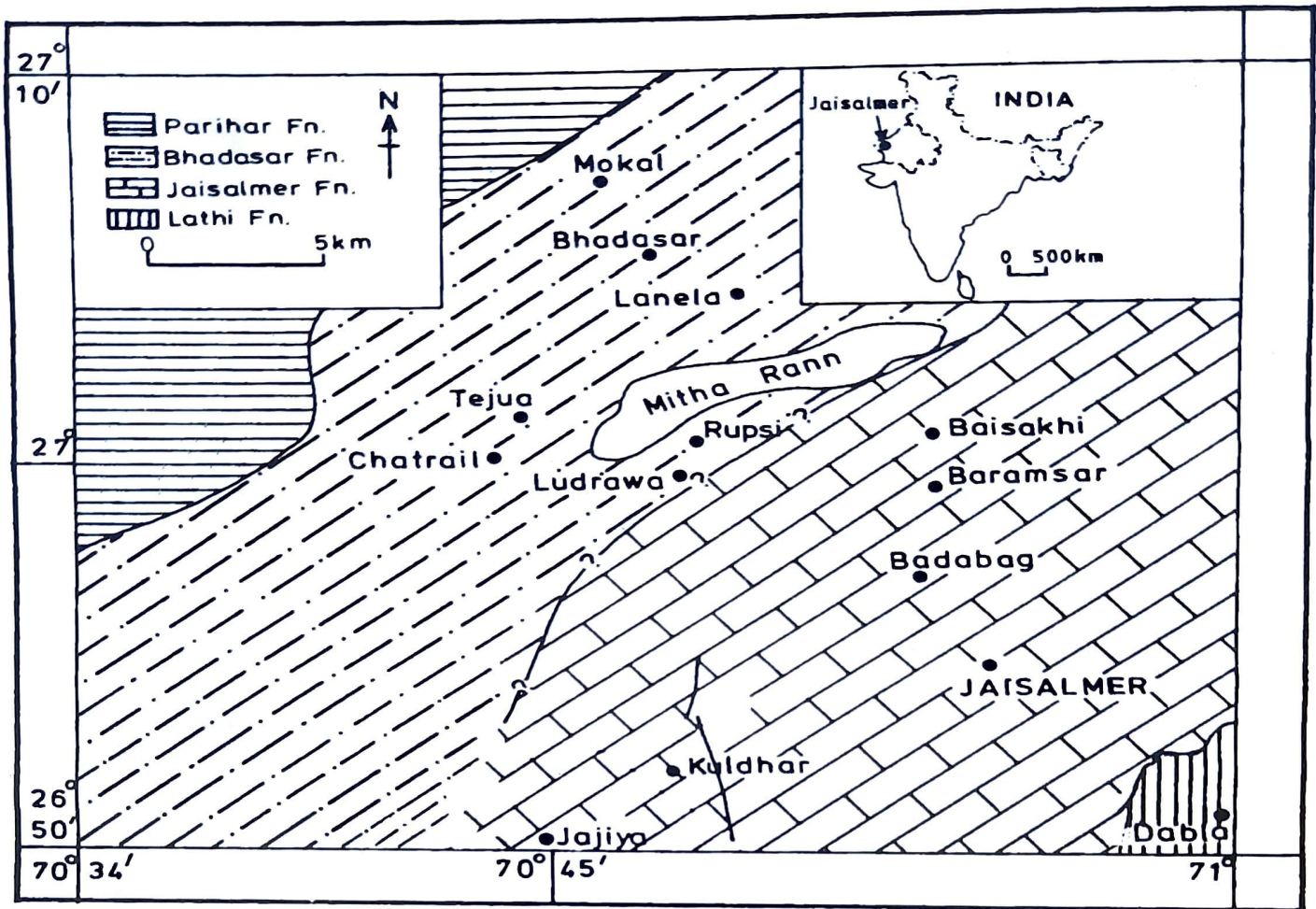


Fig. 1. Schematic geological map of Jaisalmer (modified after Krishna, 1980).

PRESENT STUDY

The 5-fold scheme (Oldham 1886) of Lathi Formation, Jaisalmer Formation, Bhadasar Formation (inclusive of Baisakhi Formation of Swaminath *et al.* 1959), Parihar Formation and Abur (= Habur) Formation in ascending order constitutes the lithostratigraphic framework in the basin.

The *ca.* 96 m thick (exposed part) Bhadasar Formation (Krishna *et al.* 1996a, Pandey & Krishna 1996) includes three members, namely Rupsi Member, Bhadasar Member and Mokal Member in ascending order (Table 1). The present study is restricted to the Rupsi Member and Bhadasar Member (Fig. 2). The base of the formation is unexposed and the contact with underlying Jaisalmer Formation is disconformable. A total of 25 ammonoid rich levels are recognised in the Rupsi Member and Bhadasar Member of Bhadasar Formation (Fig. 2). The Rupsi Member is best developed in and around the Rupsi village. The base is unexposed. It has yielded ammonoids from 11 stratigraphic levels (Fig. 2). The ammonoid genera identified in this member are *Aulacosphinctoides*,

Virgatosphinctes, *Hildoglochiceras*, *Haploceras*, *Holcophyloceras* and *Pterolytoceras*. The overlying Bhadasar Member is best developed around Tejua and Bhadasar villages in Jaisalmer. Its contact with underlying Rupsi Member is unexposed while the contact with the overlying (ammonoid devoid) Mokal Member (*ca.* 40 m thick) is sharp. It has yielded ammonoids from 14 stratigraphic levels (Fig. 2). The ammonoids from Bhadasar Member have been assigned to the genera, *Aulacosphinctes*, *Virgatosphinctes*, *Corongoceras* and a new genus (flat ventered multiplicate form).

Lithological and fossil contents of these lithostratigraphic units are summarized below:

Rupsi Member (Beds 1 to 4, Fig. 2)

Base not exposed :

Bed 1 : 5.20 m thick, yellowish to earthy yellow, thin (5 to 10 cm thick) maroon to yellowish maroon, medium to fine grained, nodular, concretionary, sandstone bands, ammonoids rare, mainly indeterminate virgatosphinctin fragments, belemnites and fossil wood relatively frequent.

Table 1: Review of Late Middle and Late Jurassic lithostratigraphic framework in the Jaisalmer Basin.

DASGUPTA, 1975		KACHHARA & JODHAWAT, 1981		GARG & SINGH, 1983		KRISHNA, 1983		KRISHNA, 1987		PANDEY & KRISHNA, 1996	
BHADASAR FN.	MOKAL Mb.	BHADASAR FN.		BHADASAR FN.	Unconformity	BHADASAR FORMATION	MOKAL Mb.	BHADASAR FORMATION	MOKAL Mb.	BHADASAR FORMATION	MOKAL Mb.
	KOLARDUNGAR Mb.						BHADASAR Mb.		BHADASAR Mb.		BHADASAR Mb.
BAISAKHI FN.	RUPSI Mb.	BAISAKHI FN.		BHADASAR FORMATION	RUPSI SHALE Mb.	BHADASAR FORMATION	RUPSI Mb.	BHADASAR FORMATION	RUPSI Mb.	BHADASAR FORMATION	RUPSI Mb. (Includes Ludharwa Mb.)
	LUDHARWA Mb.								LODARWA Mb.		
	BAISAKHI Mb.								BAISAKHI Mb.		
Unconformity				Unconformity				7		Unconformity	
JAISALMER FORMATION	KULDHAR Mb.	JAISALMER FORMATION	JAJIYA Mb.	JAISALMER FORMATION	KULDHAR OOLITE Mb.	JAISALMER FORMATION	KULDHAR Mb.	JAISALMER FORMATION	KULDHAR Mb.	JAISALMER FORMATION	KULDHAR Mb. (Includes carbonate Succession exposed W of Baisakhi village, earlier designated as Baisakhi Mb.)
	BADABAG Mb.		BADABAG Mb.								
	FORT Mb.		FORT Mb.								
	JOYAN Mb.		JOYAN Mb.								
	AMARSAGAR LIMESTONE Mb.		AMARSAGAR LIMESTONE Mb.								
	JAISALMER Mb.		JAISALMER Mb.								
HAMIRA Mb.	HAMIRA Mb.										

Beds 2a – 2x : ca 16.70 m thick, alternation of variegated gypseous shale/silt with occasional concretions enclosing ammonoids and maroon/yellowish maroon/ash maroon to deep brown/ferruginous, medium to fine grained, thin (10 to 40 cm thick) concretionary, nodular, pebbly, boxworked and bioturbated sandstone bands, ammonoids, belemnites and fossil wood frequent, particularly ammonoids frequent from 2d – 2q (except for 2f, 2h and 2j), and rare indeterminate virgatosphinctin fragments from 2a – 2c, 2r – 2x, 2f, 2h and 2j.

Beds 3a – 3c : 4.50 m thick, variegated, coarse grained, friable, cross bedded with occasional slump structure and bioturbated sandstone (3b) sandwiched between two conglomeratic horizons at the base (3a) and top (3c), unfossiliferous.

Bed 4 : ca 1.60 m thick, grey, medium to fine grained, massive, hard and compact, persistent, micaceous, jointed sandstone, unfossiliferous.

Bhadasar Member (Beds 5 to 11c, Fig. 2)

Bed 5: unexposed

Beds 6a – 6g : ca 2.40 m thick, variegated, highly gypseous shale/silt/silty shale with occasional concretions enclosing ammonoids alternating with three thin (10 to 20 cm thick), maroon to ash maroon, medium to fine grained pebbly, nodular, concretionary, bioturbated sandstone bands, belemnites, ammonoids frequent and fossil wood relatively poor.

Bed 7 : 0.80 m thick marker bed, yellowish maroon to

ferruginous, coarse to even gritty, hard, nodular, pebbly, concretionary, fractured sandstone band, highly fossiliferous, belemnites, ammonoids and fossil wood frequent, other fossils (bivalve, brachiopods, gastropods, corals etc.) rare.

Bed 8 : 12.20 m thick, variegated gypseous shale/silt/silty shale intercalated with several thin (5 to 10 cm thick), maroon, grey to ash maroon, flaky, medium to fine grained sandstone bands, unfossiliferous except for a few bands with occasional trace fossils.

Beds 9a – 9d : 4.00 m thick, marker bands, maroon to yellowish maroon, ferruginous, coarse to even gritty, hard and compact, pebbly, nodular, concretionary, bioturbated, calcareous sandstone bands, highly fossiliferous, coquina type (ammonite bank), ammonoids, belemnites and fossil wood frequent, bivalve, brachiopods, corals, echinoids etc., relatively rare.

Beds 10a – 10g : 4.20 m thick, earthy yellow to whitish gypseous shale/silty shale/silt alternating with thin (20 to 40 cm thick) maroon/yellowish maroon to ash maroon, coarse grained, concretionary, friable to hard, fractured, boxworked, bioturbated sandstone bands, fossiliferous, ammonoids frequent (only from beds 10b, 10d, 10f), belemnites and fossils etc. relatively rare.

Beds 11a – 11c : 4.40 m thick, maroon to yellowish maroon, ferruginous, coarse grained, friable to fractured, boxworked, bioturbated sandstone bands (11a & 11c) separated by silty shale/shale (80cm thick) band (11b),

poorly fossiliferous, ammonoids, belemnites and fossil wood etc. rare.

AMMONOID STRATIGRAPHY

Out of about 250 precisely collected ammonoid specimens, over 180 are found moderately to well preserved and have been subjected to detailed taxonomic determinations as under:

- Virgatosphinctinae** - *Aulacosphinctoides* and *Virgatosphinctes*.
- Calliphyloceratinae** - *Holcophyloceras*

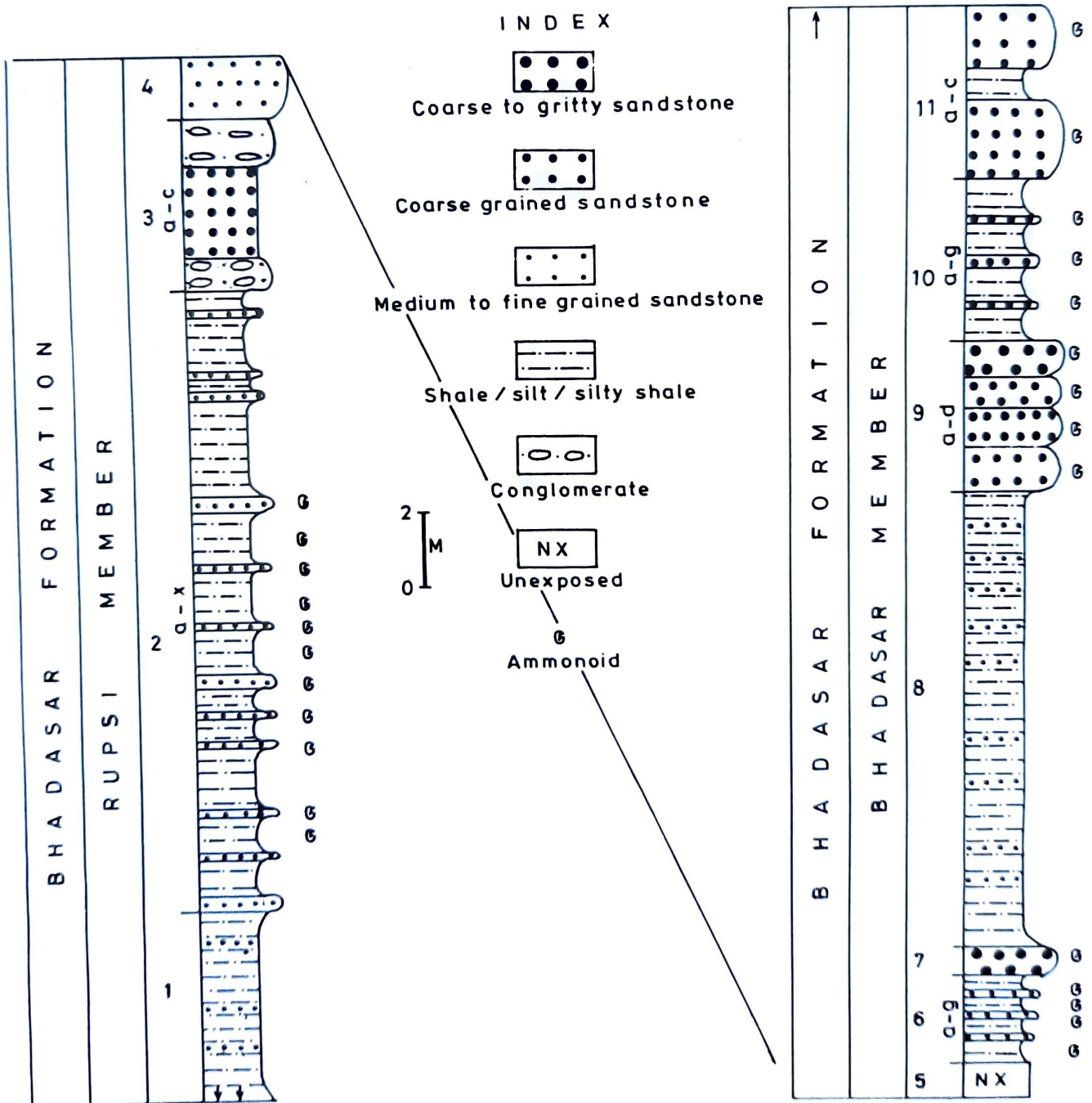
Haploceratinae - *Haploceras* and *Hildoglochiceras*

Himalayitinae - *Aulacosphinctes* and *Corongoceras*

Pterolytoceratinae - *Pterolytoceras*

In addition to above a flat ventered, multiplicate new virgatosphinctin form of generic rank is also recorded.

The biostratigraphic evaluation of the Tithonian ammonoid fauna of Jaisalmer has been made in context of high resolution Indo – East-African ammonoid zonation



scheme (Krishna *et al.* 1996b) developed earlier in Kachchh. The generic/species range chart (Fig. 3) allows recognition of 3 of the 4 zones of the Kachchh Tithonian scheme: Virgatosphinctoides Zone, Communis Zone and Densiplicatus Zone along with addition of a new zone – the Natricoides Zone in Jaisalmer. The Virgatosphinctoides Zone is revised to include Natricoides Zone in between the emended Virgatosphinctoides Zone below and Communis Zone above in the Tithonian of western India. The Natricoides Zone (well developed only in Jaisalmer) is indicated by the first appearance of *Aulacosphinctoides natricoides* (Uhlig) at the base of bed 2d. *Hildoglochiceras*, *Haploceras*, *Halcophyloceras* and *Virgatosphinctes* are also recorded in this interval. The succession underlying this zone in Jaisalmer belongs to the emended Virgatosphinctoides Zone. Neither the zonal index *Katrolliceras virgatosphinctoides* Krishna & Pathak nor any species of *Aulacosphinctoides* common with Kachchh are recorded from this interval in Jaisalmer. Instead, there are only indeterminate virgatosphinctin fragments present in this interval. The Natricoides Zone is further differentiated into 4 subzones/horizons. The Communis Zone and Densiplicatus Zone are recognised in Jaisalmer on the basis of the appearances of their zonal indices along with other characteristic taxa higher up in the stratigraphic column. Each of these two zones are found divisible into their subzones also in the Jaisalmer basin (Fig. 3). The Kachchh Communis Zone (Krishna *et al.* 1966b), earlier placed as the oldest zone of the Late Tithonian, is now included as the youngest zone of the Early Tithonian (Figs. 3, 4, 5). However, there is no indication of the basal Tithonian Pottingeri Zone in Jaisalmer.

AMMONOID ZONES/SUB ZONES/ HORIZONS

Virgatosphinctoides Zone (emend.) (Beds 1 to 2c) : The interval beds 1 to 2c in Jaisalmer is poorly fossiliferous and includes only indeterminate virgatosphinctin fragments. However, in view of the Natricoides Zone immediately above, beds 1 to 2c are here indirectly suspected to represent the emended Virgatosphinctoides Zone.

In view of the correlation of the overlying Natricoides Zone with the Semiforme Zone of the European Tethyan standard as discussed later the Virgatosphinctoides Zone (emend.) is indirectly suggested here to correspond to the North Tethyan Darwini Zone (Figs 3, 4, 5).

Natricoides Zone (Beds 2d to 2l) : The base of this zone is marked by the first appearance of

Aulacosphinctoides natricoides (Uhlig), *Hildoglochiceras latistrigatum* (Uhlig), *H. kobelii* (Oppel), *Aulacosphinctoides doghlaensis* Fatmi, *A. linoptychus* (Uhlig), *A. hyderi* Fatmi, *Virgatosphinctes pumpeckji* Uhlig, *V. krafti* Uhlig, *Haploceras cf. elimatum* (Oppel) and *Halcophyloceras mesolcum* (Dietrich) also appears for the first time within this zone.

It is further differentiated into 4 subzones/horizons namely Natricoides Subzone/N-I Horizon, Doghlaensis Subzone/N-II Horizon, Pumpeckji Subzone/N-III Horizon and Krafti Subzone/N-IV Horizon in ascending order (Figs. 3, 5).

Natricoides Subzone/N-1 Horizon (Beds 2d to 2f) : The base of this Subzone/Horizon is indicated by the first *Aulacosphinctoides natricoides* (Uhlig) and the first *Hildoglochiceras latistrigatum* (Uhlig).

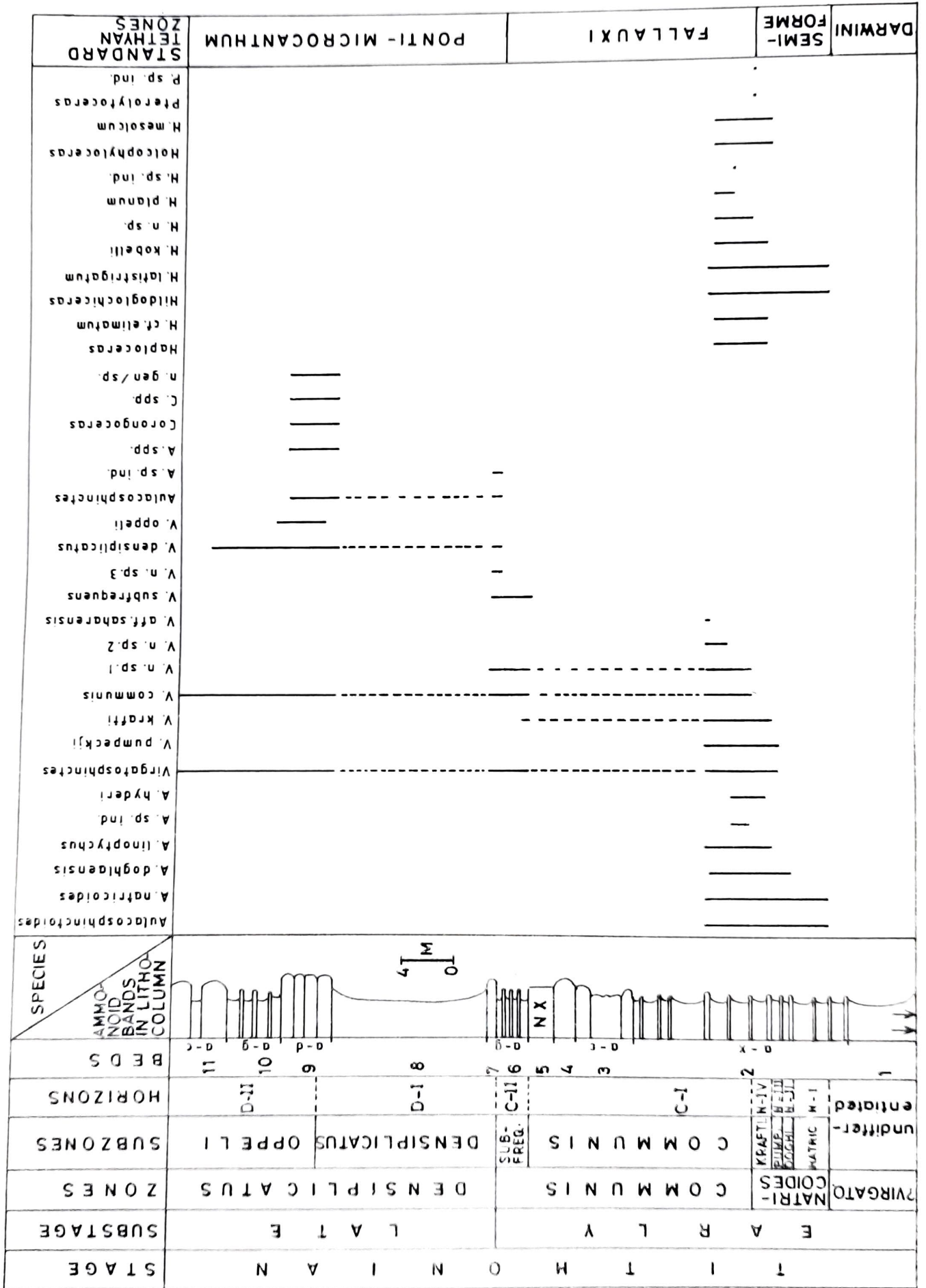
Doghlaensis Subzone/N-II Horizon (Beds 2g to 2h) : Its base is marked by the first *Aulacosphinctoides doghlaensis* Fatmi, *A. natricoides* (Uhlig) and *Hildoglochiceras latistrigatum* (Uhlig) continue from below.

Pumpeckji Subzone/N-III Horizon (Beds 2i to 2j) : Its base is indicated by the first *Virgatosphinctes pumpeckji* Uhlig. *Aulacosphinctoides natricoides* (Uhlig), *A. doghlaensis* Fatmi and *Hildoglochiceras latistrigatum* (Uhlig) continue from below.

Krafti Subzone/N-IV Horizon (Beds 2k to 2l) : The base of this Subzone/Horizon is marked by the first *Virgatosphinctes krafti* Uhlig with *Aulacosphinctoides linoptychus* (Uhlig) and *Halcophyloceras mesolcum* (Dietrich). *Hildoglochiceras kobelii* (Oppel), *Haploceras cf. elimatum* (Oppel) and *Aulacosphinctoides hyderi* Fatmi also mark their first appearances within this subzone. *Aulacosphinctoides natricoides* (Uhlig), *A. doghlaensis* Fatmi and *Virgatosphinctes pumpeckji* Uhlig continue from below.

The Natricoides Zone (well developed only in Jaisalmer) includes rare Mediterranean (Tethyan) element *Haploceras*. In view of the presence of *Haploceras*, the Natricoides Zone suggests its correspondence with the Semiforme Zone of North Tethyan margin (Figs. 3, 4, 5).

Communis Zone Krishna *et al.* 1996b (Beds 2m to 2n) : In conformity with Krishna *et al.* (1996b), the Kachchh Communis Zone is recognised in Jaisalmer by the first *Virgatosphinctes communis* Spath.



STAGE	SUBSTAGE	TETHYAN ZONES	INDO-EAST-AFRICAN KACHCHH ZONES KRISHNA et al 1996	JAISALMER
TITHONIAN	LATE	DURANGITES	DENSIPLICATUS	DENSIPLICATUS
		MICROCANTHUM		COMMUNIS
		PONTI	NATRICOIDES	
	EARLY	FALLAUXI	VIRGATOSPHINCT.	? VIRGATOSPHINCT.
		SEMIFORME		POTTINGERI
		DARWINI		
		HYBONOTUM		

Fig. 4 : Tithonian ammonoid zones recognised in Jaisalmer.

Virgatospinctes subfrequens Uhlig also appears first in this zone. *V. aff. saharensis* Spath and *Hildoglochiceras planum* (Waagen) are restricted within this zone. *Hildoglochiceras latistrigatum* (Uhlig), *H. kobelii* (Oppel), *Haploceras cf. elimatum* (Oppel), *Holcophyloceras mesolcum* (Dietrich), *Aulacosphinctoides natricoides* (Uhlig), *A. doghlaensis* Fatmi, *A. linoptychus* (Uhlig), *Virgatospinctes pumpeckji* Uhlig and *V. kafti* Uhlig mark their last occurrences.

The two subzones/horizons namely Communis Subzone/C-I Horizon and Subfrequens Subzone/C-II Horizon have also been identified in Jaisalmer (Figs 3, 5).

Communis Subzone/C-I Horizon (Beds 2m to 5m; unexposed) : It is indicated by the first appearance of *Virgatospinctes communis* Spath. *Virgatospinctes aff. saharensis* Spath and *Hildoglochiceras planum* (Waagen) are restricted within this subzone. *Aulacosphinctoides natricoides* (Uhlig), *A. doghlaensis* Fatmi, *Virgatospinctes pumpeckji* Uhlig, *Haploceras cf. elimatum* (Oppel), *Hildoglochiceras latistrigatum* (Uhlig), *H. kobelii* (Oppel) and *Holcophyloceras mesolcum* (Dietrich) mark their last occurrences within this subzone.

Subfrequens Subzone/C-II Horizon (Beds 6a to 6g) : It is recognised by the first appearance of

Virgatospinctes subfrequens Uhlig. *Virgatospinctes communis* Spath continues from below.

In addition to the species common with Kachchh, the Communis Zone in Jaisalmer includes species of *Haploceras*, *Hildoglochiceras*, *Holcophyloceras* and *Pterolytoceras*. It may be noted that there are no definite Late Tithonian marker genera (*Aulacosphinctes*, *Corongoceras*, *Microcanthoceras*) present in this zone. However, the Late Tithonian genera *Aulacosphinctes* and *Corongoceras* are found to occur in the overlying Densiplicatus Zone in Jaisalmer and hence the Communis Zone is here transferred to early Tithonian as its youngest zone. Further in view of its position above the Natricoides Zone and below the Densiplicatus Zone (= Ponti-Microcanthum Zone of Europe), the Communis Zone broadly corresponds to the Fallauxi Zone of the European Tethyan standard (Figs 3, 4, 5).

Densiplicatus Zone Krishna et al. 1996b (Beds 7 to 11c) : This zone is recognised in Jaisalmer by the first appearance of the zonal index *Virgatospinctes densiplicatus* (Waagen). *Virgatospinctes oppeli* Spath, *Aulacosphinctes* spp. and *Corongoceras* spp. are restricted in this zone. *V. communis* Spath and *V. subfrequens* Uhlig continue from below and mark their last appearances within this zone.

This zone in Jaisalmer has been differentiated into two subzones/horizons namely Densiplicatus Subzone/D-I Horizon and Oppeli Subzone/D-II Horizon (Figs 3, 5).

Densiplicatus Subzone/D-I Horizon (Beds 7 to 9a) : It is recognised by the first appearance of *Virgatospinctes densiplicatus* (Waagen). The genera *Aulacosphinctes*, *Corongoceras* and a new form also mark their first appearances in this Subzone/Horizon. *Virgatospinctes communis* Spath continues from below and *V. subfrequens* Uhlig marks its last appearance.

Oppeli Subzone/D-II Horizon (Beds 9b to 11c) : This Subzone/Horizon is recognised by the first appearance of *Virgatospinctes oppeli* Spath which is restricted within this Subzone/Horizon. *V. densiplicatus* (Waagen) and *V. communis* Spath as also the genera *Aulacosphinctes*, *Corongoceras* and a new form mark their last occurrence within this Subzone/Horizon.

The definite Late Tithonian marker genera *Aulacosphinctes* and *Corongoceras* record their first appearance along with continuation of *Virgatospinctes* from below in Densiplicatus Zone in Jaisalmer. Similarly in the Late Tithonian of Kachchh the genera

POLARITY-CHRON	STAGE	SUB STAGE	TETHYAN ZONES	ZONES	SUBZONES	HORIZONS	AGE IN Ma	
							HAQ et al. 1987	JACQUIN et al. 1994
M 19 ↑		L A T E	DURANGITES	DENSIPPLICATUS	FREQUENS	D - III	134	141.2
			MICROCANTH.		OPPELI	D - II		
M 20			PONTI	COMMUNIS	DENSIPPLICATUS	D - I	145.2	
					SUBFREQUENS	C - II		
					COMMUNIS	C - I		
					KRAFTI	N - IV		
M 21			FALLAUXI	NATRICOIDES	PUMPECKJI	N - III	146.0	
					DOGHLAENSIS	N - II		
					NATRICOIDES	N - I		
M 22		E A R L Y	SEMIFORME	VIRGATOSPHINCT.	BIPPLICATUS	V - V	146.6	
					RAJNATHI	V - IV		
						V - III		
					PERRINSMITHI	V - II		
						V - I		
M 22A ↓			HYBONOTUM	POTTINGERI	SPARSICOSTA	P - III	147.6	
						P - II		
					POTTINGERI	P - I		
							140	148.2

Fig. 5 : Indian Tithonian ammonoid zones correlated to the West European Tethyan ammonoid zones and magnetic polarity framework.

Virgatospinctes, *Aulacospinctes* and *Microcanthoceras* occur together in several sections (Krishna *et al.*, 1996b).

In view of the presence of definite Late Tithonian genera *Aulacospinctes*, *Corongoceras* and *Microcanthoceras* in West Indian Densiplicatus Zone, this zone is retained here in Late Tithonian and also corresponds to Ponti-Microcanthum. Zone interval of North Tethyan margin (Figs 3, 4, 5).

CONCLUSION

The Tithonian ammonoid zonal scheme of Kachchh (Krishna *et al.*, 1996b) is well recognised and extended to Jaisalmer. In the Indo – East-African Tithonian ammonoid Standard Zonation scheme developed earlier in Kachchh, the first appearance of *Virgatospinctes* was considered to mark the base of Late Tithonian. In the present work the occurrence of *Virgatospinctes* with *Hildoglochiceras* and *Haploceras* reveals that *Virgatospinctes* has already originated in late Early Tithonian. As such *Virgatospinctes* cannot be used for marking the base of Late Tithonian. On the other hand, the Tithonian Himalayitinae is now recorded from Jaisalmer. Thus the base of Late Tithonian in India is revised to begin with the first Himalayitinae. This is a better and closer approximation for marking the base of Late Tithonian than *Virgatospinctes*; still it does not correspond to the European Tethyan standard.

In light of the above, the Early/Late Tithonian boundary in India is now placed at the base of Densiplicatus Zone with first Himalayitinae. The revised western Indian Tithonian ammonoid zonation scheme now incorporates 5 zones, 14 subzones and 17 horizons (Fig. 5). The Indian Tithonian ammonoid stratigraphic record in its present state of knowledge is considered to be nearly complete along with improved correlations with Tethyan Standard Zonation Schemes (Figs. 3, 4, 5).

ACKNOWLEDGEMENTS

The financial support from CSIR to Dr. B. Pandey as SRA (Pool Officer) is gratefully acknowledged.

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