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ANISIAN STAGE (MIDDLE TRIASSIC) IN HIMALAYA WITH SPECIAL REFERENCE TO CONODONTS

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ABSTRACT

Though the marine Triassic strata have been well known from the Tethys Himalaya for the last several decades, there have been few serious studies on the Triassic of Himalaya relating to high resolution stratigraphy on the basis of ammonoids and conodonts. Conodont investigations undertaken in India and outside have revealed that conodonts are not only fairly persistent over thousands of kilometres and extremely useful in stratigraphic correlation but also relevant in the identification of even substages of Early, Middle and Late Triassic of the Himalaya.

In Kashmir, the boundary zone between the Scythian and the Anisian is well developed. The earliest Anisian, i.e. E. Aegean substage is marked by a distinctive conodont zone referable to *C. timorensis*. It is possible to distinguish the Late Anisian on the basis of ammonoid fauna but there is no strong basis for the Middle Anisian.

In Ladakh, the presence of Earliest Anisian, i.e. Aegean, Middle and Late Anisian intervals has been established in the Tamba Kurkur Formation.

In Spiti, the Anisian conodont assemblages have been recorded and illustrated from the upper part of the Tamba Kurkur Formation. Analysis of Anisian conodonts faunas from Spiti shows that interval corresponding to Early Anisian and Late Anisian is well represented.

In Malla Johar (Kumaun Himalaya), conodonts have been described from the Kalapani Limestone (Late Olenekian through Carnian). Conodont investigations reveal that all the substages – Aegean, Bithynian, Pelsonian and Illyrian can be identified here. The facies and conodont faunas of the Kalapani Limestone are very similar to those known from the lower part of the Hallstatt Limestone of the Epidaurus section in Greece.

Key words: Triastsic conodonts, Anisian Stage, Himalaya.

INTRODUCTION

The Triassic succession is excellently developed all over the length of the Tethys Himalaya from Afganistan and Kashmir in the northwest through Zanskar and Spiti to Kumaun and even Nepal in the southeast. Traditional stratigraphy of the Triassic is largely based on ammonoids and other megafossils such as bivalves. In the last few decades, conodont investigations have been undertaken in different palaeontological laboratories in North America, Europe and Asia and it has now become increasingly clear that conodonts have a far wider geographic distribution as compared to other fossil groups, i.e. ammonoids and have the proven potential in high resolution stratigraphy and precise correlation of the Triassic rocks. The purpose of this paper is to discuss the Anisian Stage (Middle Triassic) on the basis of the available ammonoid and conodont data in different parts of Himalaya.

In the Himalaya, most of the recovered conodont faunas are from the Scythian and the Anisian sequences. The investigations

connected with conodonts have shown that they are of considerable value not only in stratigraphic work but also in the precise identification of various geological events.

LITHOSTRATIGRAPHY AND CONODONT FAUNAS FROM ANISIAN SEQUENCES

Kashmir

Palaeozoic and Triassic sequences are well developed in most of the areas in Kashmir. Foundation of the stratigraphy of Kashmir was laid down by Middlemiss (1910). There was no major work for over 70 years after the work of Middlemiss until Nakazawa *et al.* (1975) studied the Late Permian and Early Triassic with main emphasis on Permian-Triassic boundary based on a detailed study of the Guryal Ravine section in Srinagar district. The Khunamoh Formation which includes the Latest Permian to Early Triassic succession was founded by Nakazawa *et al.* (1975). Chhabra and Sahni (1981) studied conodont assemblages from the sequence of Olenekian age (Late Early Triassic). Matsuda (1985) worked out the conodont biostratigraphy of Early Triassic of Kashmir and recognized most of the conodont zones of the standard zonation in the Khunamoh Formation.

The Khreuh Formation and the Wuyan Formation include the sediments of Middle and Late Triassic ages, respectively. The Anisian strata are part of the Khreuh Formation whose type area is located near Khreuh village in Srinagar district. Most of sediments are predominantly clastic in nature and extraction of conodonts is difficult. As a result, most of our knowledge of the biostratigraphy of Khreuh Formation is still based largely on ammonoids and other megafossils recorded by Middlemiss (1910) and Diener (1912). Two distinct ammonoid-bearing horizons reported by Middlemiss (1910) in the Khreuh Formation at the Khreuh are "*Gymnites* bed" from the calcareous sandstone exposed at the summit of the temple hill, and a calcareous bed higher in the sequence which includes *Ptychites, Buddhaites rama, Gymnites, Orthoceras* and *Ceratites thuillieri.* Ammonoids occur in association with bivalves which are dominated by *Pseudomonotis*. Ammonoid fauna suggests a Late Anisian age.

Although most of the conodont zones of Early Triassic have been recognized in Kashmir, Anisian conodonts have been recorded only from the Nodular Limestone sequence. Chhabra and Sahni (1981) and Matsuda (1983, 1985) reported the presence of *Chiosella timorensis* Zone which is now known to be characteristic of Early Aegean, i.e. Earliest Anisian interval.

Spiti and Zanskar regions

Triassic succession of Spiti (fig. 1A) is world famous and is known for its complete sedimentary record. The foundation of the stratigraphy of Spiti was laid down as a result of the pioneering work by Hayden (1904) and Diener (1912). Srikantia (1981) was first to work out the lithostratigraphy of the Triassic of Spiti and he proposed five formations is ascending order: 1. Tamba Kurkur Formation, 2. Hanse Formation, 3. Nimaloksa Formation, 4. Alaror Formation and 5. Simokhambda Formation. Thus, the Triassic of Spiti, i.e. Lilang Group begins with the Tamba Kurkur Formation which corresponds to *Otoceras* Zone: *Ophiceras* Zone, *Meekoceras* Zone, *Hedenstroemia* beds, horizons of *Rhynchonella griesbachi* and *Pseudomonotis himaica;* Nodular Limestone, Lower and Upper Muschelkalk subdivisions of Hayden (1904). Thus, the Tamba Kurkur Formation includes the time interval ranging from the earliest Triassic to the latest Anisian.

Triassic conodonts of Spiti were studied by Goel (1977) and Bhatt *et. al.* (1981). A major contribution to Permian-Triassic boundary has been made by Bhatt *et al.* 1981 based on conodont investigation of the *Otoceras* bed. In recent years, significant work on stratigraphy, microfacies and Palaeo-environment of Lilang Group has been carried

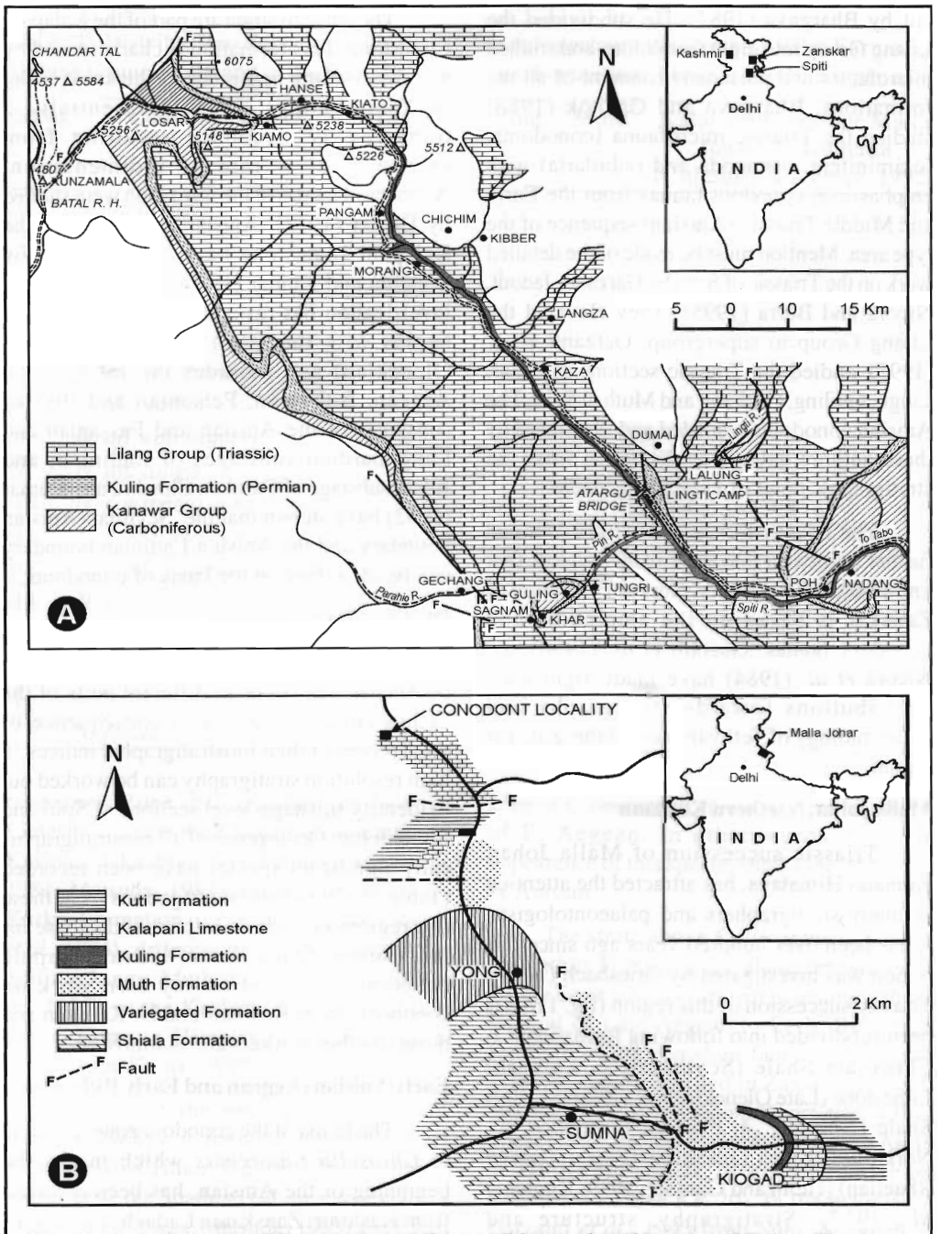


Fig. 1. Geological map of Palaeozoic and Triassic litho-stratigraphic units of Tethys Himalaya; A-Spiti, H.P. (After Bagati, 1990) B-Malla Johar, N. Kumaun (After Kumar *et al.*, 1977)

out by Bhargava (1987). He subdivided the Lilang Group into eight formations and studied microfacies and palaeoenvironment of all the formations. Bhargava and Gadhok (1988) studied the Triassic microfauna (conodonts, foraminifera, ostracoda and radiolaria) with emphasis on conodont faunas from the Early and Middle Triassic (Anisian) sequence of the type area. Mention must be made of the detailed work on the Triassic of Spiti by Garzanti, Jadoul, Nicora and Berra (1995). They elevated the Lilang Group to supergroup. Garzanti *et al.* (1995) studied the Triassic sections at Losar, Lingti, Guiling, Gechang and Muth in Spiti. The Anisian conodonts recorded and illustrated by these authors have been discussed from the stratigraphic point of view in this paper.

The Triassic formations of Spiti continue further northwest into the Zanskar region. Our knowledge of the Tamba Kurkur Formation of Zanskar is based on the ammonoid and conodont faunas. Gaetani *et al.* (1986) and Nicora *et al.* (1984) have made significant contributions towards stratigraphy and palaeontology of Tethyan zone of the Zanskar region.

Malla Johar, Northern Kumaun

Triassic succession of Malla Johar, Kumaun Himalaya, has attracted the attention of many stratigraphers and palaeontologists. It has been over hundred years ago since this region was investigated by Griesbach (1891). Triassic succession of this region (fig. 1B) has been subdivided into following formations: 1. Chocolate Shale (Scythian); 2. Kalapani Limestone (Late Olenekian to Carnian); 3. Kuti Shale (Norian); 4. Passage Formation (L. Norian); 5. Kioto Limestone (Latest Tiassic/ Rhaetian) (Heim and Gansser, 1939; Kumar *et al.*, 1977). Stratigraphy, structure and palaeoenvironment of the Palaeozoic and theTriassic sequences have been studied by Kumar *et al.* (1977).

The Anisian strata are part of the Kalapani Limestone. This formation is characterised by nodular bedding and reduced thickness (30m in Yong Valley). This is essentially a transgressive sequence resulting from extremely slow rate of sedimentation. Ammonoid faunas of the formation were studied by Diener (1912). Anisian conodonts of the Kalapani Limestone have been studied by Chhabra and Kumar (1989, 1992). Conodont investigation has revealed that this sequence begins with the latest Early Triassic (L. Olenekian) and includes the intervals of Aegean, Bithynian, Pelsonian and Illyrian substages of the Anisian and Fassanian and Langobardian substages of Ladinian; and Julian substage of Carnian. Chhabra and Kumar (1992) have shown that the Scythian-Anisian boundary and the Anisian-Ladinian boundary can be identified on the basis of conodonts.

DISCUSSION

As indicated above, the conodont faunas of Anisian age occur in different parts of the Tethys Himalaya, and as a consequence of good record of their biostratigraphic indices, a high resolution stratigraphy can be worked out to identify substage-level sections of Spiti and Malla Johar. Occurrence of 17 biostratigraphically significant species have been recorded (Table 1). Conodont investigations from these two regions provide an important database for the Anisian Stage. Some biostratigraphic observations based on my own work on conodonts from Kashmir and N. Kumaun and those of other workers are as follows-

Early Anisian (Aegean and Early Bithynian)

The fauna of the conodont zone referable to *Chiosella timorensis* which marks the beginning of the Anisian, has been recorded from Kashmir; Zanskar in Ladakh; Spiti, H. P., and Malla Johar, Kumaun Himalaya. Thus, the presence of the Early Aegean has been identified in different parts of the Himalaya. *C.*

Table 1: Distribution of stratigraphically significant species in the Tamba Kurku Formation (Lilang Group), Spiti and in the Kalapani Limestone (Formation), Malla Johar, N. Kumaun.

S.No.	Conodont species	Lingti	Guiling	Muth	Kalapani Lmestone Malla Johar, N. Kumaun (Chhabra & Kumar, 1992)
1	*C. timorensis*	x	x	x	x
2	*N. regale*		x		x
3	*N. bulgarica*		x		x
4	*N. bifurcata*				x
5	*N. handbulogi*				x
6	*N. aff. shoshonensis*				x
7	*N. aff. szaboi*	x	x		
8	*N. aff. eotrammeri*	x	x		
9	*N. aff. longa*				x
10	*N. constricta constricta*			x	x
11	*N. constricta cornuta*	x		x	
12	*N. constricta postcornuta*			x	
13	*N. excentrica / N. transita*			x	x
14	*N. trammeri*	x		x	x
15	*N. fueloepi*		x		
16	*N. liebermani*		x		
17	*N. foliata*	x			

timorensis Zone distinguishes the Nodular Limestone unit of the Khunamoh Formation in Kashmir (Chhabra, 1981; Chhabra and Sahni, 1981; Matsuda, 1983), level C of the Tamba Kurkur Formation in Zanskar, Ladakh (Nicora *et al.*, 1984), different stratigraphic sections in Spiti (at Lingti, Muth and Guling) (Garzanti *et al.*, 1995); in the Kalapani Limestone, Malla Johar, Kumaun Himalaya (Chhabra, 1988; Chhabra and Kumar, 1992).

Regarding the age of *C. timorensis,* Nogami (1968) who founded this species from the material of Timor, Indonesia, believed it to characterise the Spathian (=Late Olenekian) or the Earliest Anisian. Matsuda (1985) and Carey (1984) considered that the age of this distinctive species is latest Early Triassic. In the standard zonation of Sweet (1988) and Kozur (1989), the zone of *C. timorensis* characterises the interval of E. Aegean. In other words, the first appearance of this species marks the beginning of Anisian.

The strata above *C. timorensis* Zone in the Tethys Himalaya are characterised by *N. regale* Zone which is known to distinguish the interval of Late Aegean to Early Bithynian. Presence of the conodont fauna of *N. regale* Zone has been identified in Zanskar (Level C of Tamba Kurkur Formation; Nicora *et al.*, 1984), Spiti (Tamba Kurkur Formation – sample As-19 at Guiling), and N. Kumaun (Kalapani Limestone-sample KP. 20). In the material of Garzanti *et al.*, 1995 from Spiti, *N. regale* is associated with *N. bulgarica* (juvenile specimens). The authors suggested Aegean/ Bithynian age for the conodont-bearing horizon

Table 2: Distinctive conodont species and age of the Tamba Kurkur Formation at Lingti (modified after Garzanti *et al.*, 1995).

FORMATION	METRES FROM BASE	SAMPLES	DISTINCTIVE CONODONTS	AGE
KAGA FORMATION	35.50	AS 30	*N. trammeri, N. foliata*	Ladinian
TAMBA KURKUR FORMATION	33.60	AS 29	*N.* aff. *eotrammeri*	L. Illyrian
	30.80	AS 28	*C. timorensis*	E. Aegean
	18.00	AS 27	*N. homeri*	L. Olenekian

at Guiling. At Lingti (Table 2), *N. regale* is unrepresented and the zone of *C. timorensis* is overlain by a zone which is distinguished by *N. eotrammeri* of the late Anisian age. In Kumaun also, *N. regale* occurs in association with *N. bulgarica*. Here, the conodonts are associated with a distinctive ammonoid referable to "*Hollandites*". *N. regale* can therefore is regarded as a definite indicator of E. Bithynian (Chhabra and Kumar, 1992).

N. regale has a worldwide distribution and is known from the North America, European Tethys and Asian regions. It was originally described by Mosher (1970) from the ammonoid Zone referable to *Lenotropites caurus* zone (Early Anisian but not the base) in theNorth America. It can be summarised that the presence of *N. regale* indicates Late Aegean to Early Bithynian age. In the Early Bithynian

EXPLANATION OF PLATE I

(All figures x100)

1-16 Anisian conodonts from Kalapani Limestone, Malla Johar, Kumaun Himalaya.

1, 4 ***C. timorensis*** (Nogami); lateral views, sample KP.21, 1. specimen LUGDM 25005, 4. LUGDM 25008

2 ***N. regale*** Moser; lateral view, sample KP. 20b, specimen LUGDM 25026

3 ***N. regale*** Moser transitional to *N. bulgarica* (Budurov and Stefanov), lateral view, sample KP. 19, specimen LUGDM 25027

5,6,7,9 ***N. bulgarica*** (Budurov and Stefanov); all lateral views, 5. specimen LUGDM 25036, 6. specimen LUGDM 25033, both from sample KP. 19, 7. specimen LUGDM 25042, 9. specimen LUGDM 25034, both from sample KP.18

8 ***N. kockeli*** (Tatge); lateral view, sample KP. 18, specimen LUGDM 25041

10 *N. bifurcata* (Budurov and Stefanov); a- oblique lateral view, b- upper view, sample KP. 18, specimen LUGDM 25037

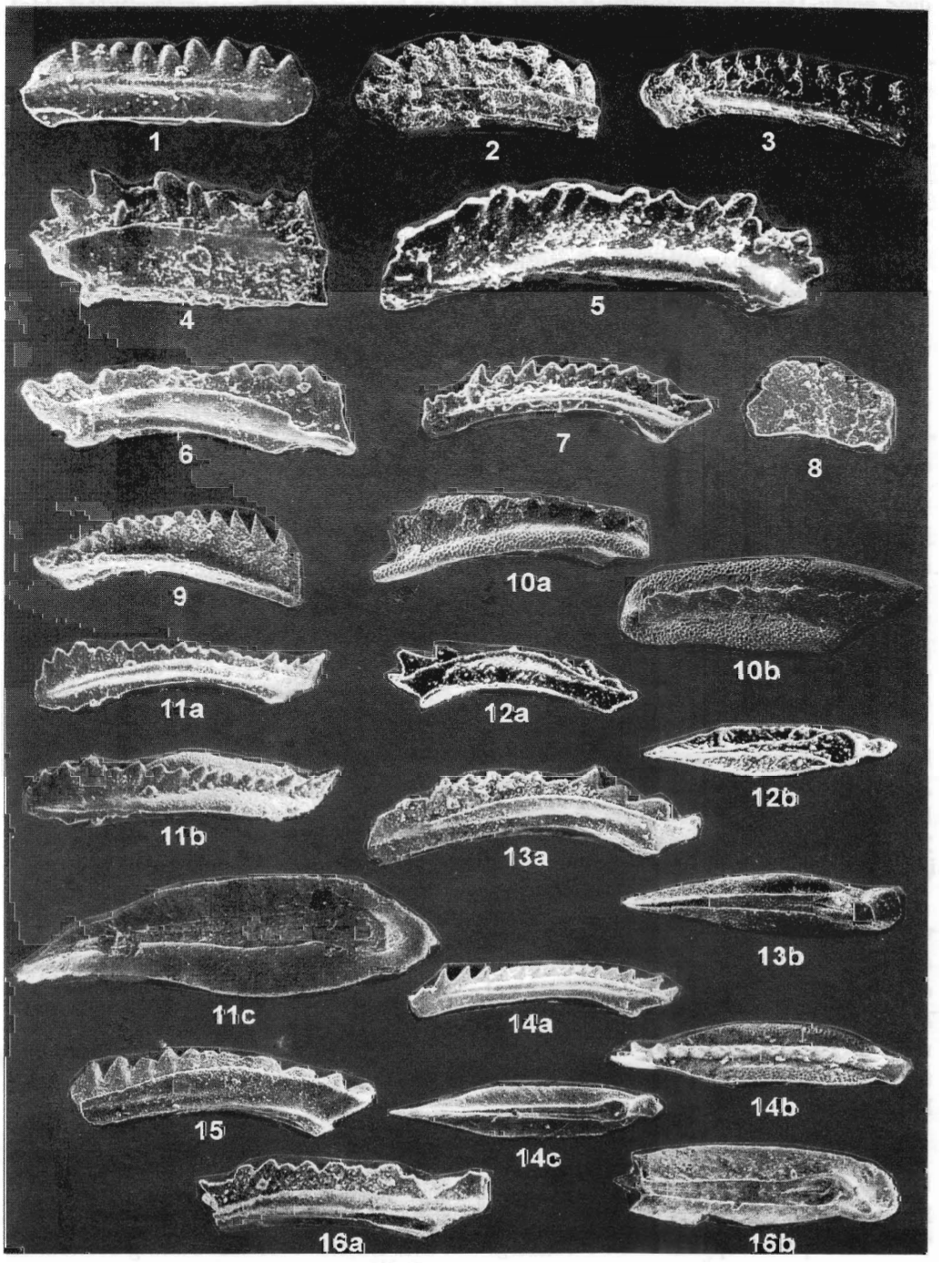
11 ***N. hanbulogi*** (Sudar and Budurov); a- lateral view, b- upper view, c- lower view, sample KP.18, LUGDM 25035

12, 13 ***N. constricta*** (Mosher and Clark); 12a- lateral view, 12b- lower view, sample KP. 17, specimen LUGDM 25066; 13a- lateral view, 13b- lower view, sample KP.15, specimen LUGDM 25065

14 ***N. aff. longa*** (Budurov and Stefanov); a- lateral view, b- upper view, c- lower view, sample KP. 17, specimen LUGDM 25064

15 ***N. trammeri*** (Kozur and Mostler); lateral view sample KP.14, specimen LUGDM 25079

16 ***N. excentrica*** (Budurov and Stefanov); a- lateral view, b- lower view, sample KP. 16 specimen LUGDM 25043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strata, *N. regale* occurs together with *N. bulgarica.*

Middle Anisian (Late Bithynian-Pelsonian)

An interval of the Ismidiscus Zone which is known to distinguish Late Bithynian in Europe, has been identified in the Kalapani Limestone (sample KP. 19) in N. Kumaun. The conodont fauna is characterised by dominance of *N. bulgarica. N. regale* is still present but forms a minor part of the assemblage, being represented by slightly curved forms. The presence of a distinctive ammonoid referable to *Salterites* in the sample confirms the Late Bithynian age for the conodont-bearing horizon of the Kalapani Limestone.

N. bulgarica Zone helps to identify the Late Bithynian to Early Pelsonian interval and it is also known from Bulgaria, Balaton Mountains in Hungary, Bithynia in Turkey and Nevada sections in the North America (Budurov and Stefanov, 1972, 1975a,b; Nicora, 1977).

Other Middle Anisian conodont faunas have been reported from Zanskar and Malla Johar. *Hollandites-Ptychites* horizon of the level C of the Tamba Kurkur Formation in Zanskar has revealed the presence of *N. bulgarica* and *N. hanbulogi* (Nicora *et al.,* 1984). The age of this horizon is Late Bithynian to Early Pelsonian. Some material of Bhargava and Gadhok (1988) from the Anisian sequence of the type area also includes *N. bulgarica* and *N. bifurcata* (in Chhabra and Kumar, 1992); thus, the age of level C of Tamba Kurkur formation in Zanskar is Late Bithynian or Early Pelsonian.

The youngest Middle Anisian conodont fauna of the Tethys Himalaya is known from N. Kumaun (Kalapani Limestone – sample KP18). The most important species of the assemblage include *N. bifurcata, N. hunbulogi* and *N. kockeli.* Although *N. bulgarica* and *N.* aff. *shoshonensis* are present, they are poorly represented. *N. bifurcata* evolves from *N. bulgarica* and it distinguishes Late Pelsonian strata in Germanic and tethyan regions. *N. bulgarica* and *N. hanbulogi* are present in the material of Kovacs and Papsova (1986) who studied the evolution of platform conodonts from southern Hungary and Czeckoslavakia. According to Chhabra and Kumar (1992), the age of the fauna is Late Pelsonian and it is stratigraphically equivalent to Szaboi Zone of Krystyn (1983) from Epidaurus section of Greece. This Himalayan condont fauna corresponds to *N. kockeli* Zone which is known to distinguish the Germanic and the European Tethyan regions. Presence of *N. kockeli* Zone has also been recognized from the Sephardic Realm (Hirsch, 1977).

Late Anisian (Illyrian)

Late Anisian interval is represented in the level C of the Tamba Kurkur Formation in Zanskar; at Guiling and Lingti sections in Spiti and the Kalapani Limestone in Malla Johar, Kumaun.

In Zanskar, the strata of the level C above *Hollandites-Ptychites* horizon have revealed the presence of *N. constricta* and *N. eotrammeri.* In Spiti, at Guiling section table 3), conodonts are known from two horizons: the lower one (sample As-20 from 31.29 m above the base of Tamba Kurkur Formation) includes *N.* aff. *eotrammeri* and *N.* aff. *szaboi* and the upper horizon (sample AS 21 from 32.04 m above the base of formation) shows presence of *N.* aff. *liebermani* and *N. liebermani* transitional to *N. fueloepi.* Garzanti *et al.* (1995) have suggested the Late Illyrian age for the conodont fauna of the Guiling section. At Lingti, the conodont-bearing horizon lies in the uppermost part of the Tamba Kurkur Formation

Table 3: Distinctive conodont species and age of the Tamba Kurkur Formation at Guiling, Spiti (modified after Garzanti *et al.*, 1995).

FORMATION	METRES FROM BASE	SAMPLES	DISTINCTIVE CONODONTS	AGE
TAMBA KURKUR FORMATION	32.04	AS 21	*N. liebermani*	
	31.29	AS 20	*N.* aff. *eotrammeri -N.* aff. *szaboi*	L. Illyrian
	29.49	AS 19	*N. regale-N. bulgarica*	Aegean/Bithynian
	28.09	AS 18	*C. timorensis*	E. Aegean
	27.09	AS 17		
	20.94	AS 16		
	18.69	AS 15	*N.* aff. *jubata-N. homeri*	L. Olenekian
	15.29	AS 14		
	13.29	AS 13		

(sample AS-29). The assemblage is characterised by *N. constricta cornuta*, *N.* aff. *eotrammeri, N.* aff. *szaboi* and *Gladigondolla* sp. Garzanti *et al.* (1995) have assigned the Late Illyrian age for this fauna. In my opinion, the fauna of Guiling and Lingti corresponds to the interval of the ammonoid Zone of Parakellnerites and the Conodont Zone of Eotrammeri from the Epidaurus section in Greece.

The study of Garzanti *et al.* (1995) from Muth (Table 4) indicates a big hiatus representing the interval of Late Aegean, Middle and Late Anisian. Above the *C. timorensis*-bearing horizon (sample HS 102), three samples (HS 103, HS 104 and HS 105) are barren and above this, the sample HS 106 indicates Early Ladinian age on the basis of the distinctive conodont species: *N. constricta constricta*, *N. constricta postcornuta, N. trammeri* and *N. fuelopi.*

Table 4: Distinctive conodont species and age of the Tamba Kurkur Formation at Muth, Spiti (modified after Garzanti *et al.*, 1995).

FORMATION	METRES FROM BASE	SAMPLES	DISTINCTIVE CONODONTS	AGE
TAMBA KURKUR FORMATION	35.80	HS 106	*N. transita/N. trammeri*	Fassanian
	34.90	HS 105		
	34.60	HS 104	Barren	
	31.00	HS 103		
	29.40	HS 102	*C. timorensis*	E. Aegean
	26.20	HS 101		
	24.60	HS 100	*N.* aff. *Jubata – N. homeri*	L. Olenekian
	13.00	HS 99		

In Malla Johar, Kumaun Himalaya (Table 5), the Late Anisian conodonts have been studied by Chhabra and Kumar (1992) from the Kalapani Limestone (samples KP. 17 and KP. 16). The Conodont fauna is characterized by dominance of *N. constricta* which occurs in association with *N.* aff. *longa, N. excelsa* and *Gladigondolella tethydes. N. constricta* zone is also known from Rotelliforme and Meeki Zones in North America (Mosher and Clark, 1965; Nicora and Kovacs, 1984).The Late Anisian beds of the Kalapani Limestone have been correlated with the coeval sequences from Turkey, Greece and the Alps. It is stratigraphically equivalent to *Eotrammeri* Zone of Krystyn (1983) from Epidaurus, Greece, but there is a difference concerning conodont biofacies. In the Himalayan fauna, *N. eotrammeri* is unrepresented and *Gladigondolell tethydes* is very rare.

Table 5: Conodont zones in the Anisian stage of the Kalapani Limestone of Malla Johar, N. Kumaun (modified after Chhabra and Kumar, 1992).

FORMATION	SAMPLES	CONODONT ZONES	SUBSTAGE	STAGE
KALAPANI LIMESTONE	KP. 15	*N. exentrica*	Fassanian	E. LADINIAN
	KP. 16 KP. 17	*N. constricta*	Illyrian	ANISIAN
	KP. 18	*N. bifurcata-N. kockeli*	Pelsonian	
	KP. 19	*N. bulgarica*	L. Bithynian	
	KP. 20	*N. regale*	E. Bithynian	
	KP. 21	*C. timorensis*	E. Aegean	
	KP. 22	*N. homeri*		L. OLENEKIAN

This Illyrian conodont fauna from Kumaun is succeeded by the fauna of *N. excentrica* Zone which is known to distinguish Anisian- Ladinian boundary.

CONCLUSIONS

1. Conodont investigations in different parts of the Himalaya confirm that the Earliest Anisian, i.e. E. Aegean is very well developed. It is represented by *C. timorensis* known Kashmir, Zanskar, Spiti and the Kumaun Himalaya.
2. Late Anisian, i.e. Illyrian substage is well represented in the Tethys Himalaya. In Kashmir, it is recognized on the basis of a distinctive ammonoid fauna. In Zanskar, Spiti and the Kamaun Himalaya, the conodont assemblages confirm the presence of the Late Anisian.
3. Investigation of Nicora *et al.* (1984) from Zanskar, Ladhakh reveal that besides the Aegean, there is a definite conodont basis for Bithynian and Pelsonian substages.
4. Anisian conodont faunas studied by Garzanti *et al.* (1995) from Spiti confirm that the Early Aegean and Illyrian are very well developed but there is no firm basis for the middle part of the Anisian. Contrary to this, the conodont investigation by Bhargava and Gadhok (1988) reveals that some part of the middle Anisian (L. Bithynian-Pelsonian) is present on the basis of *N. bulgarica* and *N. bifurcata* in the type area of the Lilang Group.

5. Conodont investigation of the Kalapani Limestone, Malla Johar, Kumaun by Chhabra and Kumar (1992) clearly show that the Anisian Stage is well developed, although the sequence is much reduced in thickness. Here, the conodont faunas are helpful in identifying the Aegean, Bithynian, Pelsonian and Illyrian substages.

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