JOURNAL OF THE PALAEONTOLOGICAL SOCIETY OF INDIA
VOL. 25, 1981, pp. 110—129 (*For* 1980)

RECENT ADVANCES IN MICROPALAEONTOLOGICAL INVESTIGATIONS OF THE MARINE TRIASSIC ROCKS OF INDIA

PREM N. AGARWAL AND S. N. SINGH[1]

DEPARTMENT OF GEOLOGY, LUCKNOW UNIVERSITY, LUCKNOW-226 007

ABSTRACT

Present paper is an attempt to take stock of the achievements and to assess furtherance of studies in the field of micropalaeontological investigations of the marine Triassic rocks of India during last quarter century.

The marine fossiliferous Triassics, comprising mainly limestones, dolomites and calcareous shales, are extensively developed in different parts of the Himalaya. A wealth of information on megafossils, such as ammonites, brachiopods, pelecypods etc, has long been known from these rocks. The achievements of the pioneers in the field of ammonite biostratigraphy of the Himalayan Triassics is well documented in the Triassic literature. However, no subsequent substantial addition to our knowledge of the biostratigraphy of the Himalayan Triassic seems to have been made.

As a sequel to growing significance of micropalaeontologic biostratigraphy and its gradual refinement for Triassic sequences, mainly on the basis of conodonts, in many countries, Indian micropalaeontologists also started searching Triassic microfossils and consequently a number of papers, short-notes and reports, with regard to presence of conodonts, ostracodes, foraminifera, holothurian sclerities, micromolluscs, microvertebrates, microplanktons etc., from the Himalayan Triassics, have been published during the last 15 years. However, majority of the published information, with the exception of that on the conodonts, has been restricted to records and, to some extent, general systematics without noticeable contribution on biostratigraphical and palaeoenvironmental studies and applicable parameters.

Subsequent to the first record of Triassic conodonts from Kashmir in Indian sub-continent by Srivastava and Mandwal (1966), considerable data on Triassic conodonts from India has not only been added but their utility in biostratigraphy has also been demonstrated.

Some methods of retrieving the present position requiring thorough investigations of the marine Triassic microfossils, their precise identification, detailed taxonomy, evolutionary trends and history of ontogenic development, usefulness for precise biostratigraphical zonation and palaeoenvironmental reconstruction have also been suggested.

INTRODUCTION

The marine Triassic rocks are widely distributed in extrapeninsular India in a more than 2,000 km stretch of the Himalaya from Pamir in the northwest, through Afghanistan, Salt Range (Pakistan), Kashmir, Spiti, Kumaun and Garhwal to Nepal and to as far as Burma in the northeast. They occur in the south as well as in the north of the Central Crystallines ; the former may include the Krol-Infra Krol sequence of unsettled age while the latter is a part of Tethyan succession representing an almost uninterrupted succession from pre-Cambrian to ?Eocene (Heim and Gansser, 1939 ; Gansser, 1964 ; Shah and Sinha, 1975 and Kumar *et al.*, 1977). Recent work in the regions of Bhallesh (Raina *et al.* 1971 and Kapoor, 1973), Chamba (Gupta, 1971 ; Bhattacharya *et al.* 1971 ; Datta and Singh, 1973 ; Rattan, 1973) and Tandi (Gupta, 1974 b) brought to light a number of Triassic beds, which were previously regarded as early Palaeozoic. These new finds occur to the south of the Central Crystallines, which was contrary to the then prevalent belief that the fossiliferous marine Triassics were restricted to the north of the Central Axis, except the Kashmir region.

Thick succession of the Himalayan Triassics can be divided into the Bunter, Muschelkalk and Keuper, corresponding to three subdivisions in Europe. They exhibit a remarkable similarity in lithological and faunistic facies with the Triassics of Eastern Alps. Although there is a close faunistic relationship between distant outcrops of the Himalayan Triassics, yet there is a considerable variation in the facies of the lithological assemblages and relative thickness of the Lower, Middle and Upper divisions. According to Wadia (1975) the Lower Triassic is over 100 metres thick in Kashmir, 50 m in Byans and only 12 m in Spiti. The Middle Triassic is 275 m thick in Kashmir ; the entire thickness is restricted to the Muschalkalk, the Ladinic Stage, till lately, being regarded as absent. Recently, Verma and Sastry (1963) and Sastry and Verma (1976) reported, at Pastun (Kashmir), presence of *Daonella* spp. (*D.* cf. *D. lommeli* and *D. indica*) of supposed Ceratitan age, thus proving existence of the Ladinic Stage in Kashmir. In Spiti, Kumaun and Byans it is further reduced, although containing a rich fossil fauna of both the Muschalkalk and Ladinic Stages. The Carnic and Noric Stages are present in the Gurais rgeion (Kashmir) in a 1,200-1,800 m

[1]Deceased on 17.9.1980.

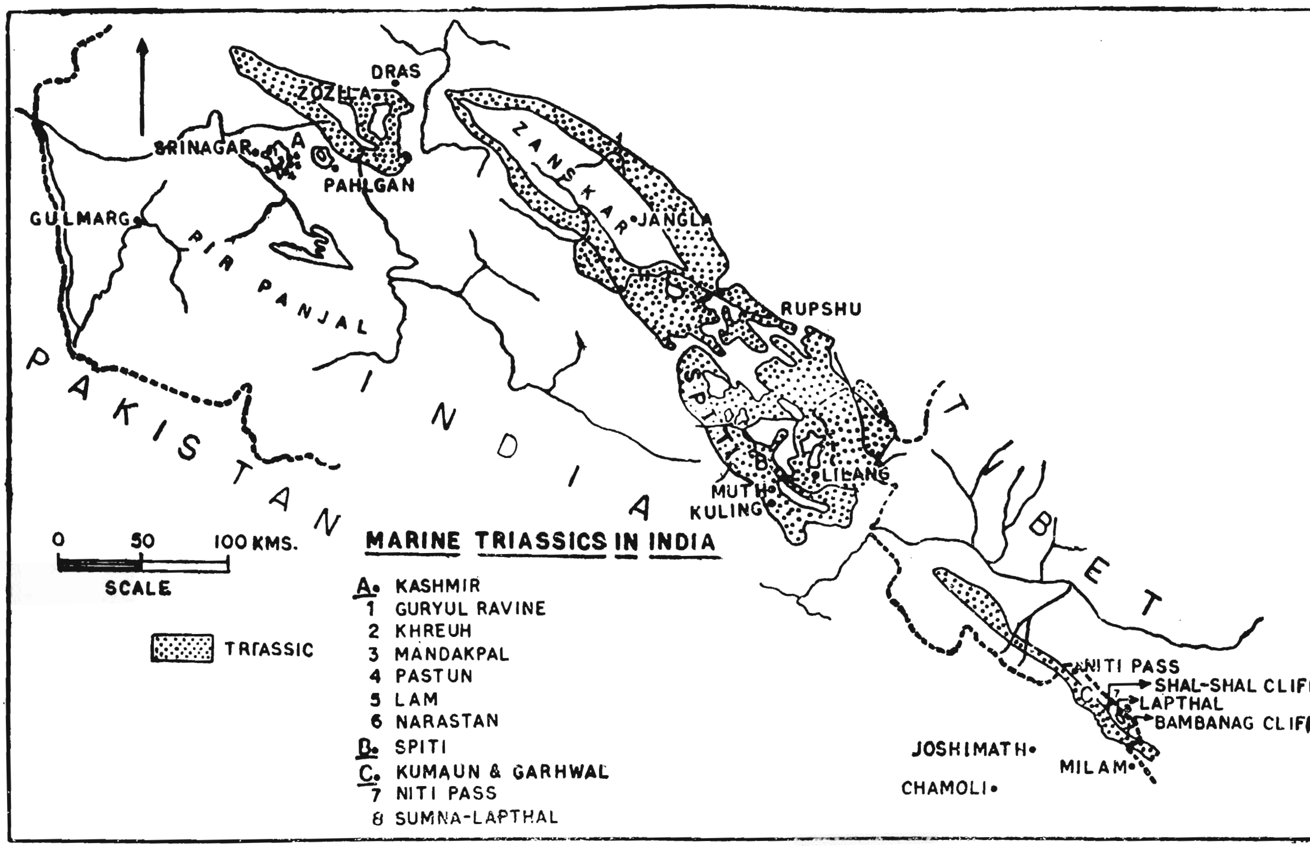

Fig. 1. A sketch map showing Triassic localities of Trans-Himalaya and Kashmir, from where microfauna has been reported. (based on Gansser, 1964).

pile of massive well-bedded limestone without fossils. In Spiti the Carnic and Noric Stages are represented by more than 1,000 m thick strata which is dominantly calcareous, while in Kumaun and Garhwal the Upper Triassics are not calcareous and are 400-600 m thick but with many richly fossiliferous horizons. The topmost Triassics, everywhere, in the Himalaya, are represented by *Megalodon* (=Kioto) Limestone.

The ammonites of the Himalayan Triassics are ornamented, whereas in the corresponding stages in the Alpine region the ammonites are mostly without ornamentation. This difference in the ammonites of the same age is, according to Kummel (1960), due to difference in the environment of the deposition evidenced by high clay content in the carbonates of the Himalaya and little or no clay in the carbonates of the Alps.

The Himalayan Triassics conformably succeed the underlying Permian formation. The passage is quite conformable, gradual and even transitional, both stratigraphic as well as faunistic. Recently, however, a physical break in continuity of the Dzhulfian *Productus* Shale and overlying carbonate strata of the *Otoceras* Zone has been detected in the form of a 10-12 cm thick lateritic/limonitic pebbly layer at Spiti by Bhatt *et al.* (1980). Azmi (1980 c) observed in the Gechang section of the Parahio valley (Spiti) the presence of *Ophiceras connectens* Schiendewolf in the lowermost limestone bed in contact with Permian Kuling Shale. The matrix of this ammonite is reported to have yielded a rich conodont assemblage dominated by *Neogondolella carinata* indicating a hiatus of very short duration between the Permian and Scythian, on account of which *Anchignathodus typicalis* Zone in the basal Triassic is reported to be missing in this section.

The Himalayan Triassics are chiefly composed of limestones, dolomites and calcareous shales with a treasure of fossils entombed within them. The fauna includes megainvertebrates, such as ammonites, pelecypods, brachiopods, gastropods etc., which has mainly been worked out and described by Diener (1912, 1913) besides significant contribution by Griesbach (1880). Consequent to a revolution in the scope and extent of micropalaeontology there has been inpouring of information pertaining to occurrence, in the Himalayan Triassics, of the microfossils, such as conodonts, ostracodes, foraminifera, holothurian sclerites, micromolluscs, microvertebrates, microplanktons etc., during the last 15 years. Few trace fossils have also been reported, but no published work of the presence of nannoplanktons and dinoflagellates from the marine Triassic rocks of India is known to the authors.

The ammonites have been found most useful and reliable not only for correlation of the distant outcrops but have, till lately, also been employed universally to differentiate various stages, sub-stages and even zones in the marine Triassic successions. However, as the great majority of the limestones are aphanitic without evidence of megafossils, the biostratigraphical zonation of such limestones becomes very difficult. This difficulty has been overcome by the presence of the conodonts which have been successfully utilised for biostratigraphical work in many parts of the world. Srivastava and Mandwal (1966) Nakazawa *et al.* (1975,), Nakazawa, Bando and Mastuda (1980), Misra *et al.* (1973), Sahni and Chhabra (1974b), Sweet (1970a, 1973), Gupta (1972, 1974a, b; 1976 a, b, c, d ; 1980), Gupta and Rafek (1976), Gupta and Kachroo (1977, 1978), Goel (1977), Bhatt and Joshi (1978a), Singh, Chhabra and Agarwal (1980), Azmi (1980b) and Agarwal (1980d) in India attempted conodont biostratigraphy of the Himalayan Triassics.

Nakazawa *et al.* (1975) in Guryul Ravine (Kashmir), Nautiyal and Sahni (1976) in Pahlgam (Kashmir) and Kumar *et al.* (1977) in Malla Johar area (Kumaun) attempted study of palaeoenvironment, palaeocurrent etc. in the Himalayan Triassics.

THE PERMIAN-TRIASSIC BOUNDARY

The problem of fixing the Permian-Triassic boundary is still in dispute, as in many parts of the world, the sedimentary beds encompass a concordant succession of marine fossiliferous rocks of Late Permian and Early Triassic. Palaeontologists differ in opinion with regard to the Permian-Triassic boundary, as in sections where a conformable development is observed in the fossiliferous succession from the Uppermost Permian into basal/lower Scythian the 'transition zone' often contains 'mixed Permian-Triassic fauna' like in India (Guryul Ravine, Kashmir), Pakistan (Salt Range), Southern China, U.S.A. (Wyoming), Iran, Northern Greenland, Eastern Alps, etc. (Teichert, 1968). Traditionally the Permian-Triassic boundary occupies a position between *Cyclolobus* bearing zone below and *Otoceras woodwardi* zone above, supposedly at a line where many of the Permian forms are believed to have disappeared and new forms evolved (Tozer, 1967, 1978). However, Bando *et al.* (1980) challenge this traditional boundary and have marked the Permo-Triassic transition at the top of the *Otoceras woodwardi* zone. But two of the co-authors (Bando and Nakazawa) do not fully agree with this view point and they regard the *O. woodrwardi* Zone as Triassic on the basis of fauna which, in their opinion, is different from Dorashamian fauna. Nakazawa, Bando and Mastuda (1980) studied the Guryul Ravine section in Kashmir and concluded that the *O. woodwardi* beds correspond to Lower Griesbachian. Azmi (1980 c), on the other hand, believes on the basis of presence of *Neogondolella carinata* at the base of *Otoceras* bed and absence of *Anchignathodus* that the beginning of Triassic is still below the *Otoceras woodwardi* zone within the Upper part of Kuling Shale (Permian). The present authors, however, opine that more extensive and detailed field work and laboratory study is needed to settle this Permian-Triassic boundary problem.

MICROPALAENTOLOGICAL INVESTIGATIONS

The study of micropalaeontology, in its latest orientation, lays greater emphasis to more progressive research that leads to precise understanding of complex basinal problems related not only to palaeobiology but also to palaeoecology, palaeobiogeography and palaeoclimatology. The SEM ultrastructural studies of the microfossils help in determining their morphology related to phylogeny, phenotypic varitaion and to specific, generic and familial relations.

The records of Triassic microfossils, particularly in India, are rather scanty. We are still in the beginning phase endeavouring to fill the wide gap of our existing information of the Triassic microfossils. The quantum of work, so far, done in the field of micropalaeontological researches on the Indian marine Triassics is still preliminary and inadequate as compared to the magnitude, scope and applications of the microfossils in prevalent times.

Of the published literature on the Triassic microfossils from the Himalaya, the conodonts have provided maximum biostratigraphical information. The pioneer workers in this field are Srivastava and Mandwal (1966), Sweet (1970 a, b ; 1973), Gupta and his associates (1972, 1974a, b ; 1976 a, b, c, d, ; 1977, 1978, 1980 etc.) followed by Misra *et al.* (1973), Sahni and Prakash (1973), Sahni and Chhabra (1974b), Goel (1977), Bhatt and Joshi (1978a), Joshi and Arora (1979), Singh *et al.* (1980), Agarwal (1980d), Azmi (1980b) Bhatt *et al.* (1980a, b), Nakazawa *et al.* etc.

Preliminary information of the presence of ostracodes in the marine Triassics of India has mainly been provided by Sahni and Chhabra (1974a), Goel and Srivastava (1978), Agarwal (1979, 1980a, b, c), Agarwal and Kumar (1980, 1981), Agarwal *et al.* (1979, 1980) and Gupta and Sahni (1980).

Occurrences of foraminifera from the Himalayan Triassics have been reported by Nakazawa *et al.*, (1975), Gupta *et al.* (1975), Bhatt and Joshi (1978b), Goel and Srivastava (1978), Tewari *et al.* (1978), Agarwal (1980b 1981), Agarwal and Kumar (1980), M. P. Singh *et al.* (1980) and Agarwal *et al.* (1981) etc.

Other reports of relatively lesser stratigraphical significance include those on microplankton (Nautiyal, 1975 a, b and Nautiyal and Sahni, 1976) ; microvertebrates (Misra *et al.* 1973 ; Sahni and Chhabra 1976 and Tewari *et al.*, 1978) ; holothurian sclerites (Gupta and Kachroo, 1976 ; Tewari *et al.* 1978 ; Chhabra *et al.* 1979 and Azmi, 1980a, c) ; fungal spores and disaccate pollens etc. (Tewari *et al.* 1980) and Trace fossils (Kumar *et al.* 1977).

CONODONTS

These enigmatic fossil elements of uncertain zoological affinity and function, with characteristics of an ideal index fossil, have succeeded in becoming a precise stratigraphic tool. They have played a very important role, in many parts of the world, in biostratigraphy of the Triassic sediments which are generally devoid of good megafossils. According to Tipins (1980) role of conodonts "as paleoecologic/biogeographic indicators ; as survivors in highly deformed folded and even metamorphosed strata ; and as tools in predicting hydrocarbon deposits are recent advances that promise to be of great interest to sedimentologists, structural geologists/tectonophysicists and exploration geologists."

Given below is a concise account of Triassic conodont researches in India without going into details of recent nomenclatorial changes in genera and species.

I. KASHMIR

Srivastava and Mandwal (1966) reported, for the first time, occurrence of conodonts in the Indian subcontinent from the Lower Triassics of Pastun (Kashmir). The recorded forms include *Gondolella* cf. *G. phosphorensis*, *G. nevadensis*, *G. denuda*, *Hindeodella triassica* and *Parachirognathus geiseri*. Sweet (1970b) opines that these forms may actually be *Neogonodolella carinata* and *Ellisonia triassica*.

Sweet (1970a) studied conodont fauna from the Guryul Ravine section in Kashmir and presented an illustrated account of Permian-Scythian conodonts from limestone samples collected by Teichert in 1968. He recognised four conodont assemblage zones, namely *Neogondolella carinata*, *Neospathodus dieneri* and *Neospathodus cristangalli*, above the zone of *Anchignathodus typicalis*, which straddles the Permian-Triassic boundary. He also described *Ellisonia triassica*, *E. gradata* and *E. teicherti* and suggested that the uppermost beds of the Zewan Formation at the Guryul Ravine and the uppermost Chhidru Formation of Salt Range (Pakistan) are biostratigraphically correlative.

Nakazawa *et al.*, (1975) confirmed a near similar assemblage of the conodonts in the Guryul Ravine section in Kashmir. Nakazawa, Bando and Mastuda (1980) recognised in the Lower Triassic of the Guryul Ravine section in Kashmir following condont zones : (i) *Anchignathodus typicalis* Zone, (ii) *A. parvus* Zone, (iii) *Isarcicella isarica* Zone, (iv) *Gondolella carinata* Zone (v) *Neospathodus kummeli* Zone, (vi) *N. dieneri* Zone (vii) *N. cristagalli* Zone, (viii) *Gondolella nepalensis-Neospathodus* cf. *pakistanensis* Range-Zone and (ix) *Neospathodus waageni* Zone.

Singh, Chhabra and Agarwal (1980) reported Spathian conodont fauna from the Guryul Ravine section and referred two conodont assemblage zones, *viz.*, *Neogondolella jubata* and *Neospathodus homeri*. The former is also known from Salt Range, Pakistan (Sweet 1970b) and the latter compares favourably with Lower '*homeri*' sub-zone from Chios, Greece (Bender 1968). The *Neogondolella jubata* assemblage, in association with *N. jubata*, *N. elongata*, *Neospathodus homeri*, *N. spathi* and *N. traingularis*, is obtained at a lower horizon (*Meekoceras* beds of Middlemiss 1909). The *N. homeri* assemblage, along with *N. homeri* and *N. traingularis*, but without platform conodonts, is obtained at a higher horizon. The presence of these conodonts may be found useful in demarcating the boundary between the Lower Triassic and the Middle Triassic at the Guryul Ravine section.

Gupta (1978) in his review paper mentions the occurrence of Lower Triassic conodonts from a number of localities in Kashmir. From '*Meekoceras*' beds (Middlemiss 1909) and the lower part of Member H of Nakazawa *et al.* (1975) at Guryul Ravine section, he mentions the occurrence of *Neospathodus dieneri*, *N. waageni*, *N. discreta*, *Neogondolella carinate*, *Cypridodella mülleri*, *C. conflexa*, *Ellisonia* spp. and *Neohindeodella triassica*. The *Neospathodus waageni* assemblage is reported to coincide with the ammonoid zone *Owenites-Kashmirites*. At Lam he further mentions occurrence of *Neospathodus dieneri* zone which includes *N. dieneri*, *Cypridodella conflexa*, *C. mülleri*, *Ellisonia* spp. and *Neohindeodella triassica*, in association with ostracodes. About seven metres above the top of *Neospathodus dieneri* zone in the same section he further mentions the presence of *Neospathodus cristagalli*, *Prioniodina latidentata*, *Ozarkodina tortilis*, *Enantiognathus ziegleri*, *Hindeodella triassica*, *Diplododella magnidentata*, *Cypridodella muelleri* and *C. conflexa*, together with ostracodes (*Bairdia* and *Monoceratina*) and foraminifers (Nodosaridae). From Khrew he refers presence of Spathian conodonts characteristic of *Neogondolella jubata* assemblage zone with *N. jubata*, *N. elongata*, *Neospathodus homeri* and *N. triassica*. He mentions (p. 115) that "the Nodular Limestone at Khrew, Pastan and Narastan in Kashmir has yielded *Neospathodus timorensis*, *N. homeri*, *N. triangularis*, *Cypridodella conflexa*, *C. mülleri* and *Ellisonia* spp." At Mandakpal he reports presence of *Neogondolella kockeli* and *Neospathodus homeri* from beds lying four metres above the *Neogondolella jubata* yielding beds. He further reports (p. 116), from sandy shales and intercalated limestone at Lam and Mandakpal in Kashmir, occurrence of conodonts characteristic of *Neospathodus kockeli* zone in association with *Neospathodus homeri*, *N. kedahensis*, *Cypridodella conflexa*, *C. mülleri*, *Ellisonia* spp. and *Neohindeodella triassica*. The *Neospathodus kockeli* zone, here, represents Anisian age on the basis of enclosed Anisian ammonoids, but it has been used at different stratigraphic horizons by different authors (Kozur and Mostler 1973 ; Budurov and Stefanov 1973, etc.). However, the author has not referred to the source of his information and it is not clear whether the author himself has recorded the above mentioned conodont fauna from different Triassic sections in Kashmir. Chhabra (unpublished academic thesis, Lucknow University, 1977) has recorded, described and illustrated a conodont fauna from the Triassic sections at Guryul Ravine, Khrew, Mandakpal, Pastun, Lam and Narastan in Kashmir and this fauna is almost similar to that mentioned by Gupta (1978) from the same Triassic sections in Kashmir. Further the occurrence of the conodont faunas have been given both by Gupta (1978) and Chhabra (1977) from identical horizons in the same sections. It is really a surprising coincidence, unless either of the authors has drawn upon the data of the other without proper reference and acknowledgement.

Agarwal (1980d) and Singh and Agarwal (1980) recovered from a thin-bedded grey limestone sample, enclosing *Glyptophiceras* sp. exposed at Mandakpal (Kashmir), a conodont assemblage com prising *Neospathodus dieneri*, *N. ? kummeli*, *N.* sp. indet., *Ellisonia gradata*, *E. ?clarki* and *?Hibbardella* sp. This conodont fauna points an early Lower Triassic age to these beds.

Gupta and Kachroo (1977) reported, but did not describe and illustrate, conodont fauna from two different horizons in the siliceous limestone, exposed at a place seven kilometres from Pahlgam along Pahlgam-Aru Road in Anantnag district (Kashmir). From the lower stratigraphic horizon they recorded *Neospathodus discretus*, *N. dieneri*, *N. pakistanensis*, *Xaniognathus curvatus* and *Parachirognathus symmetrica;* while from the upper stratigraphic horizon they recorded conodonts which include *Gladiogondolella tethydis*, *Hindeodella multihamata*, *H. triassica*, *Lonchodina latidentata*, *Prioniodella ctenoides*, *P. latidentata*, *P. decrescens*, *Ozarkodina tortilis*, *Cypridodella müelleri*, *Cratagnathodus kochi*, *Oncodella* cf. *O. paucidentata*, *Carnudina* sp. Besides above, some forms, such as *Hindeodella* sp., *Gondolella* sp. *Ozarkodina*, *Lonchodina* sp. and *Neospathodus* sp., have been recorded in both the horizons. These authors assigned no age to the conodont bearing horizons due to scanty material. The present authors, however, believe that on the basis of presence of *Neospathodus pakistanensis* and *Parachirognathus symmetrica* in the lower horizon and *Gladiogondolella tethydis*, *Hindeodella multihamata* and *Cratagnathodus kochi* in the upper horizon, a Dienerian-Smithian age to the lower and Anisic-Ladinic age to the upper horizons respectievly may roughly be assigned.

Gupta (1976a) reviewed the occurrence, from the Himalaya, of the conodonts and their stratigraphical implications. He gave in Table III (p. 118) a list of conodonts that occur in Lower, Middle and Upper Triassic rocks in the Himalaya. In the Lower Triassic of Guryul Ravine (Kashmir) he has marked the presence of *Hindeodella triassica*, *Gondolella* cf. *phosphorensis*, *G.* aff. *nevadensis*, *G.* aff. *denuda*, *Parachirognathus geiseri* and *Neospathodus kummeli*, but failed to give source of his information. To the best of knowledge of the present authors, Srivastava and Mandwal (1966) reported occurrence of *Hindeodella triassica*, *Gondolella* cf. *phosphorensis*, *G. nevadensis*, *G. denuda* and *Parachirognathus geiseri* from Lower Triassics of Pastun. He recorded (pp. 107-108) conodonts from the Middle and Upper Triassics exposed along Seshnag-Amarnath section in Kashmir and Lachlungla-Zanskar (Umasila) section in Ladakh. The forms recorded include *Gladiogondolella tethydis* and *Neogondolella navicula navicula* from the Lower Anisic ; *Gladiogondolella tethydis*, *Neogondolella excentrica* and *N. excelsa navicula* from the Upper Anisic ; *Neogondolella mombergensis* together with *Gladiogondolella tethydis*, *Paragondolella excelsa*, *Neogondolella navicula* and *Epigondolella hungarica*, in the Lower Ladinic; *Epigondolella mungoensis* associated with *Gladiogondolella tethydis*, *Neogondolella mombergensis*, *Paragondolella excelsa*, *Neogondolella navicula* and *Metapolygnathus polygnathiformis*, from the Upper Ladinic ; *Metapolygnathus polygnathiformis*, *Neogondolella navicula navicula* and *Epigondolella nodosa* from the Carnic ; poorly preserved *Epigondolella nodosa* and *Neogondolella navicula navicula* from the Lower Noric; *Epigondolella bidentata*, associated with *Neospathodus hernsteini* and *Neogondolella navicula steinbergensis*, from the Upper Noric (at Lachlungla-Zanskar area only) and *Neospathodus hernsteini* from the Rhaetic of Lachlungla (Ladakh). He (p. 108) recognised in the Middle and Upper Triassic rocks in Kashmir and Ladakh five conodont biostratigraphic zones : (i) *Neogondolella constricta* zone, (ii) *Neogondolella mombergensis* zone, (iii) *Epigondolella mungoensis* zone, (iv) *Metapolygnathus polygnathiformis* zone and (v) *Epigondolella bidentata* zone representing Upper Anisian, Lower Ladinian, Upper Ladinian, Upper Carnian and Upper Norian stages respectively.

Gupta in his subsequent publication (1976b) and its German version (1976c) discussed these five zones (mentioned above) as guides to the biostratigraphic zones of the Middle and Upper Triassic rocks of Kashmir and Ladakh, and utilising these five guide zones he correlated Middle and Upper Triassics of Spiti and Painkhanda (Kumaun) and compared these guide conodont species from the Himalaya with those of Europe, North America Germany, Italy, etc.

Gupta and Rafek (1976) described and illustrated 17 species of 9 conodont genera recorded by Gupta (1976a) from the Middle and Upper Triassic strata at Seshnag-Amarnath section in Kashmir and Lachungla-Zanskar section in Ladakh. Of these 17 conodont elements in the assemblage, 7 are of Compound type and 10 of Platform type. There appears to be some confusion in the statement given by the authors regarding demarcation of the Carnic stage. The statement (p. 197) reads :

"The base of the Carnic succession is demarcated at the level where *Neogondolella excelsa*, *Epigondolella mungoensis* and *E. mltidentata* disappear as these forms do not extend in strata younger than Noric."

Gupta (1976 b, c, Table III) gave the geographical distribution, in the Himalaya, of the following Middle and Upper Triassic conodonts : *Epigondolella bidentata*, *E. hungarica*, *E. mungoensis*, *E. nodosa*, *Gladiogondolella tethydis*, *G. malayensis*, *Metapolygnathus excelsus*, *M. polygnathiformis*, *Neogondolella constricta*, *N. mombergensis*, *N. naivcula naivcula*, *N. navicula steinbergensis*, and *Neospathodus hernsteini*, but Gupta and Kachroo (1977, p. 125, Table 2 B) showing distribution of the Middle and Upper Triassic conodonts from the same sections of Kashmir and Ladakh, mentioned occurrences of the following forms : *Cratanagthodus* sp., *Didymodella alternata*, *Epigondolella mungoensis*, *Gladiogondolella tethydis*, *Metapolygnathus polygnathiformis*, *Neogondolella navicula navicula*, but forms like *Enantiognathus petraviridis*, *Neogondolella excelsa*, *N. excentrica*, *N. navicula steinbergensis*, *N.* cf. *unilobata*, *Neospathodus* sp., *Ozarkodina tortilis* and *O. saginata* are shown to be present in Ladakh section only. The presence of *Epigondolella bidentata*, *E. hungarica*, *E. nodosa*, *Gladiogondolella malayensis*, *Metapolygnathus excelsus*, earlier recorded by Gupta (1976 b, c, Table III), have not been shown as present by Gupta and Kachroo (1977, Table 2 B). It is more surprising that forms like *Neogondolella constricta*, *N. mombergensis* and *Neospathodus hernsteini*, which have been shown as present in Kashmir and Ladakh by Gupta (1976 b, c, Table III) are shown as absent in Kashmir and Ladakh by Gupta and Kachroo (1977, Table 2 B). Later on Gupta and Kachroo (1978) reviewed the Triassic stratigraphy of the Himalayas and mentioned record of *Neogondoella mombergensis*, *Gladiogondolella tethydis*, *Paragondolella excelsa*, *P. navicula*, *P. polygnathiformis*, *Epigondolella mungoensis* and *E. hungarica* from Lachlungla-Zanskar area in Ladakh. These anomalies in different papers by the same author/s is not understandable, unless they are serious printing mistakes.

Gupta and Rafek (1976, Table I, p. 198) gave geographical distribution, in the Himalayas, of the same conodont taxa as given by Gupta and Kachroo (1977, Table 2 B, p. 124) but also decsribed few additional taxa, such as *Hindeodella triassica*, *Epigondolella multidentata*, *E.* cf. *multidentata*, *Neogondolella polygnathiformis*. It appears that the data obtained from the Seshnag-Amarnath section in Kashmir and Lachlungla-Zanskar section in Ladakh, with respect to conodont fauna, has been utilised by Gupta and his associates in four above referred papers of more or less similar theme, but without proper mutual cohesion resulting in anomaly and unexplicable confusion.

Gupta (1976a, pp. 119-121, Table III B) and Gupta and Kachroo (1977, pp. 125-127, Table 2 B) gave a list of conodonts occurring in the Middle and Upper Triassics of Kashmir, Ladakh, Spiti and Kumaun. These Tables include a number of conodont taxa whose age ranges do not agree with those given by Sweet *et al.* (1970) and others. For example, *Neogondolella carinata*, *Neospathodus homeri*, *N. novaehollandiae*, *N. timorensis*, *N. triangularis*, *N. waageni* and *Platyvillosus costatus* (wrongly spelt as *Platyvillus*) included in the Middle and Upper Triassics by Gupta (1976, Table III B) and Gupta and Kachroo (1977, Table 2 B) are typically Scythian forms (in Tozer's sense). Similarly a form, *Gladiogondolella tethydis*, shown in the list of Lower Triassic conodonts by the above authors ranges in age from Anisian to Ladinian-? Upper Carnian.

Tewari, Sharma and Gupta (1978) described Noric microfossils, including conodonts, *viz. Neogondolella* spp., *Epigondolella* spp. and *Cratagnathodus* spp., from a place at Zamalgam near Verinag in Anantnag district, Kashmir.

II. LADAKH

Joshi and Arora (1976, 1979) recorded from Zanskar area two Early Scythian conodont assemblages, *Neogondolella carinata* and *Neospathodus dieneri*. The former has been reported from Tangze section and also from Marling, while the latter at the boundary between Griesbachian and the Dienerian at Yuger and Marling in Ladakh.

Gupta (1978) reported presence of *Neogondolella carinata* from a limestone bed just above the *Productus* Shales exposed in Sarchu Plains. Earlier Gupta (1976a) reported Middle and Upper Triassic conodont fauna from Lachlungla-Zanskar section in Ladakh.

Gupta and Kachroo (1978) mentioned occurrence of *Neospathodus hernsteini* from the Rhaetic-Liassic sediments at Ladakh.

Gupta and Budusov (1980) recorded *Neocavitella indica* sp. nov., in association with *Paragondolella steinbergensis*, from a limestone bed, about 30 metres above the beds yielding *Juvavites*, at top of Lach-Lung-La, Ladakh.

With the exception of the above cited work, the 150 metres thick Middle Triassic strata in Kashmir has not been properly investigated for the microfossils and there is no adequate palaeontological data available to subdivide them into stages, substages and zones. Similarly the Upper Triassics in Kashmir have also provided meagre faunal data, however, its position below the fossiliferous Jurassic beds and above the Ladinic Stage confirms the existence of the Upper Triassics here.

III. HIMACHAL PRADESH

Sweet (1973) referred Lower Triassic conodonts from Guling and Muth in Spiti and reported *Anchignathodus typicalis*, *Ellisonia gradata*, *E. teicherti* and *E. triassica* from matrix of *Otoceras*, collected from Muth by Dr. Eigel Nielson.

The matrix of *Ophiceras* specimens from Muth and Kuling yielded conodonts such as *Ellisonia triassica*, *Neogondolella carinata* and *Neospathodus kummeli* from Muth and *Ellisonia gradata*, *E. triassica*, *Neogondolella carinata*, *Neospathodus cristagalli* and *N. dieneri* from Kuling.

Goel (1977) described and illustrated an early and late Middle to early Late Triassic conodonts from Khar section between Guling and Muth in Pin river valley, Spiti. The reported conodonts include : *Neogondolella*, *polygnathiformis*, *Xaniognathus* cf. *X. newpassensis*, *N. navicula navicula*, *Neospathodus timorensis*, *N.* sp. aff. *N. waageni*, *N. waageeni*, *N. spitiensis* n. sp., *N. dieneri*, *N. labiatus* n. sp., *N. novaehollandiae*, *N. homeri*, *N. triangularis*, *Platyvillosus costatus*, *Neogondolella carinata* and *N. planata* together with several elements of *Ellisonia*, the presence of which points the upper part of the *Otoceras-Ophiceras* Zone, in the oldest part of the sequence. The absence of both the *Anchignathodus* and *Neogondolella carinata* from the basal part of the Khar section, as explained by the author, may be due to the absence of rocks representing the *Otoceras-Ophiceras* Zone. The oldest fauna in the Khar section, is represented by *Neospathodus novaehollandiae*, which is of Smithian age (McTavish, 1973), followed by *N. labiatus* n. sp., *N. dieneri*, *N. spitiensis* n. sp., *N. waageni*, *N.* aff. *N. waageni*, *N. homeri* and *N. traingularis*.

Gupta (1974b) reported occurrence of *Neospathodus dieneri*, *Ellisonia* sp., *Xaniognathus* sp. and *Neogondolella* sp. from the lower part of Tandi Limestone in southern Lahaul (Himachal Pradesh). This palaeontological find has been useful in establishing existence of Permo-Triassic strata which was previously regarded as early Paleozoic. This discovery is very significant since its occurrence to the south of the Central Axis is contrary to the belief that the fossiliferous marine Triassics are confined to the north of the Central Axis only.

Bhatt and Joshi (1978a) reported conodonts from the Permo-Triassic strata exposed on the left bank of Spiti river, about 1.5 Km downstream from the confluence of Lingti river in Spiti. The reported forms include, *Anchignathodus* sp. cf. *A. typicalis*, *Neogondolella carinata*, *Ellisonia triassica*, *E. gradata*, *E. nevadensis*, *E.* sp. cf. *E. teicherti*, *Hibbardella* sp. cf. *H. subsymmetrica*, *Neospathodus dieneri*, *N. kummeli*, *N. cristagalli*, *N.* sp. n. sp., *Xaniognathus curvatus*, *X. deflectens*, *X.* sp. n. sp., *Prioniodella prioniodellides* and *Lonchodina* sp. cf. *L. aequiarticulata*. This conodont assemblage from the base of *Otoceras* bed to the lower part of "*Meekoceras*" bed points an age from Griesbachian to Middle/Upper Dienerian.

Bhatt, Joshi and Arora (1980 a) described a new species of conodont, *Neospathodos praekummeli*, from Lower Triassic of Spiti, marking the base of *Ophiceras* bed. They believe that the Dienerian guide species *Neospathodus kummeli* is likely to have evolved from *Neospathodus praekummeli* n. sp. towards the base of *Ophiceras* bed. These authors (1980 b) observed that the *Otoceras* Zone in Spiti is thicker than what was previously regarded and contains many platform conodonts, a few of which characterise late Permian strata. First appearance of *Neospathodus*, a dominantly Triassic conodont, in the *Ophiceras* bed lead these authors to doubt the status of *Otoceras* Zone as base of the Lower Triassic.

Azmi (1980 b) studied five stratigraphic sections of Early and Middle Triassic at Spiti and observed all the conodont zones of the Scythian established by Sweet (1970 b), except the earliest, the *Anchignathodus typicalis* Zone. He also identified typical Middle Triassic conodonts, viz., *Neogondolella constricta*, *N. mombergensis*, *N. balkanica*, *N. bifurcata*, *N. excelsa*, *N. cornuta*, *N. excentrica*, *N. longa*, *N. suhodolica* and *N. basisymmetrica*, but could not ascertain their zonal utility. He believes that the presence of *Neogondolella carinata* and absence of *Anchignathodus* at the base of *Otoceras* bed indicates that the Triassic begins from the upper part of Kuling Shale (Permian). His observations, however, do not tally with those of Bando *et al.*, (1980) who prefer to place the Permian-Triassic transition at the top of *Otoceras woodwardi* Zone.

IV. KUMAUN HIMALAYA

Gupta (1972) reported from the Lower Triassic rocks exposed at Nabi Khad, near Talla Nabi Dhang, 6 Km from Kalapani, Malla Johar region, a conodont assemblage represented by *Neospathodus dieneri*, *Neogondolella carinata*, *Roundya* sp. and *Parachirognathus* sp. This report is significant since it is the first record of the Lower Triassic conodonts from this region. Gupta (1978), however mentions, without giving reference, occurrence of *Anchignathodus typicalis* and *Neogondolella carinata* from northeastern Kumaun.

Sahgal, Mehrotra and Jangapangi (1980) recorded species of *Neogondolella* and *Neospathodus* from the '*Otoceras* Zone' (Early Triassic) of Shalshal area, Kumaun Himalaya. The details of this work are, however, awaited.

Misra, Sahni and Chhabra (1973) described and illustrated Anisic conodont assemblage from Niti Pass area in Painkhanda (Kumaun). The conodont fauna has been found associated with foraminifera, ostracodes, microfish remains and fragments of skeletal remains. Of the conodonts, the platform types dominate over coupound types by over 60 per cent. A check-list of the conodonts recovered is given below :

Platform conodonts : *Gondolella constricta*, *G. mombergensis*, *G. navicula*, *G. nevadensis*, *G. nitiensis* sp. n., *G. jangapangii* n. sp., and *G.* sp. indet.

Compound conodonts : *Hindcodella multihamata*, *Lonchodina mülleri*, *Ozarkodina tortilis*, *Prioniodina latidentata*, *Prioniodella ctenoides* and *Enantiognathus* sp. This Middle Triassic conodont assemblage is closely similar to that of Mediterranean and of North America.

Sahni and Prakash (1973) reported, from Rhaetic arenaceous limestone exposed adjacent to Chhota Hoti near Shalshal cliff in Painkhanda, Kumaun Himalaya, *Neospathodus lanceolatus*, which was later on shown by them to be a junior synonym of *Neospathodus hernsteini*.

Chhabra, Sahni and Kumar (1973) reported Middle Triassic conodonts belonging to 13 genera and 40 species, including 8 new species, from the Kalapani Limestone about 5 km east of Sumna towards Lapthal in Kiogar Valley. This fauna was later on described and illustrated by Sahni and Chhabra (1974 b). A check-list of the forms described is given below :

Compound forms : *Chirodella ?erecta*, *Cratagnathodus kochi*, *C. budurovi* sp. n., *C. mallajoharensis* sp. n., *C. lapthalensis* sp. n., *Cypridodella conflexa*, *C. mülleri*, *C. mediocris*, *C. spengleri*, *C.* sp. A., *Diplododella lautissima*, *D. dieneri* sp. n., *D. magnidentata*, *Enantiognathus ziegleri*, *Hindeodella suevica*, *H. nevadensis*, *?H. riegeli*, *H. multihamata*, *H. triassica*, *H. kiogarensis* sp. n., *H.* sp. A., *Lonchodina* sp., *Neospathodus mosheri* sp. n., *Oncodella paucidentata*, *Prioniodella decrescens*, *P. pectiniformis*, *P. prioniodellides*, *P. erecta* sp. n., *Ozarkodina tortilis*, *O. saginata*, *O.* sp. A., *Prioniodina latidentata*, *P. libita*, *P. sweeti* sp. n., *P. petrae-viridis*, *P.* sp. A., *P.* sp. B., and Gen. *et* sp. *indet.*

Platform types : *Neogondolella mombergensis*, *N. con- stricta*, *N. huckeriedei*, *Paragondolella*, *excelsa*, *P. navicula navicula*, *P.* sp. A.and *Gladiogondolellatethydis*.

According to Sahni and Chhabra (1974 b, p. 260) the above conodont assemblage represents the ammonite rich middle part of the Kalapani Limestone corresponding to the Upper Anisian-Lower Ladinian Stages of the Alpine region, since almost all the conodont species from this region (with the exception of *Paragondolella navicula*) are characteristic of the Middle Triassic *Gladiogondolella tethydis* assemblage of the Alpine region.

Sahni and Chhabra (1974 b, fig. 2, p. 261) (wrongly printed as fig. 1) have shown the lower limit of *Neogondolella constricta* and *N. mombergensis* into the Lower Anisic, whereas according to Sweet *et al.*, (1970) these species form the characteristic Upper Anisic and Lower Ladinic Zones respectively. Since these authors have recovered this conodont assemblage from a single sample (T. 55) (as given on p. 259), there seems no reason to extend the range of *Neogondoella constricta* and *N. mombergensis* down to the Lower Anisic.

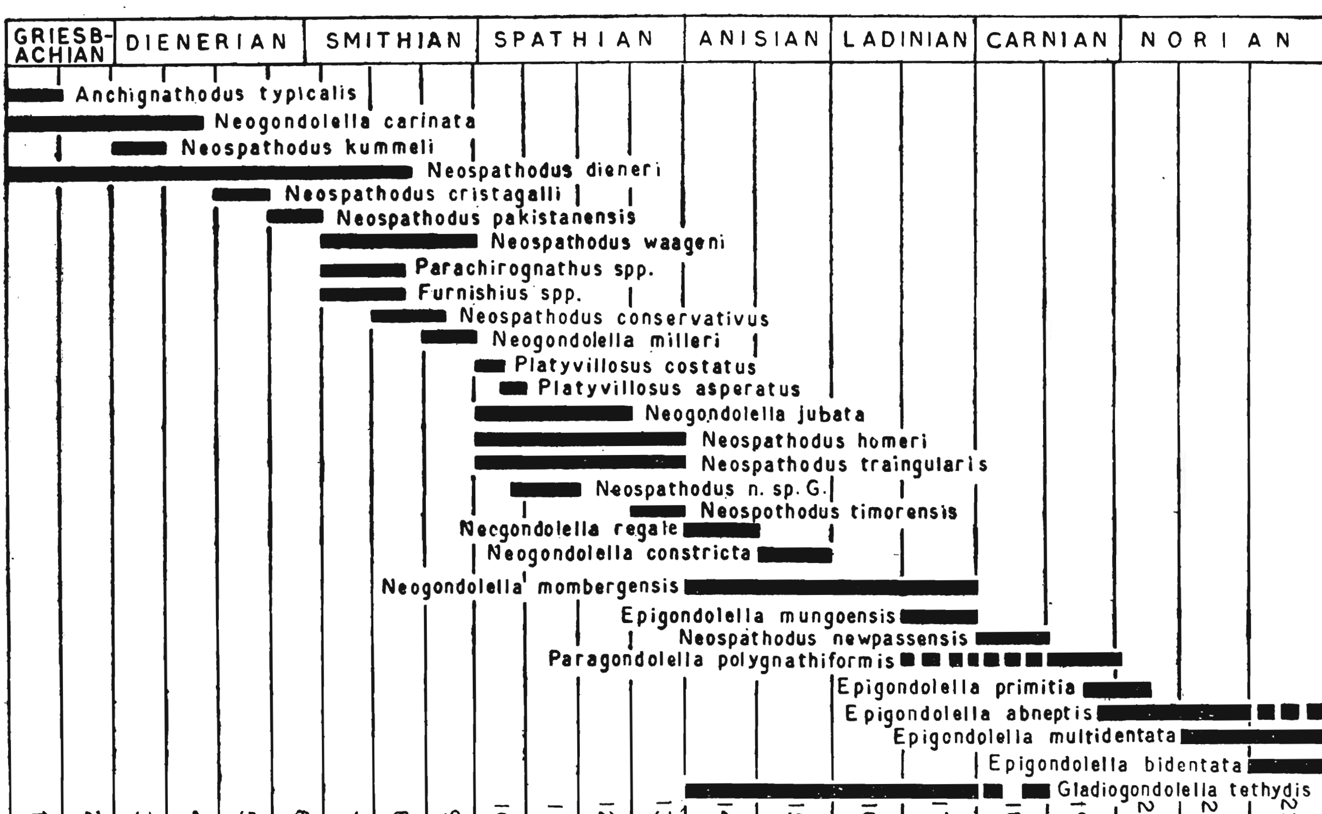

Fig. 2. Range chart of biostratigraphically significant Triassic conodont species (modified after Sweet *et. al.* 1970).

The Malla Johar conodont fauna (Sahni and Chhabra, 1974 b) appears slightly younger than the conodont fauna of Niti Pass area (Misra *et al.*, 1973).

Gupta (1980) reported Upper Triassic (Norian) conodonts from calcareous beds associated with the marly horizon near the base of Kioto Limestone exposed near Kuti in northeastern Kumaun. The forms identified are : *Gondolella steinbergensis*, *Metapolygnathus abneptis abneptis*, *M. abneptis spatulatus*, *M. posterus* and *M.* aff. *M. posterus*. However, a detailed paper on these conodont species is awaited.

Srivastava (1974) reported the occurrence of broken conodonts from black shales/cherts with associated Phosphorite Zone of Mussoorie Synform from Company Khad near burial ghats of Mussoorie. According to the author (p. 110) the recovered conodonts are too fragmentary for specific determination, but are reminiscent of *Gondolella*. A number of samples of the black shales/cherts with the associated Phosphorite Zone from same locality in Mussoorie and also from Maldeota were also macerated by one of us (PNA) but no conodont elements could be recovered. Recently Azmi, Joshi and Juyal (1980) claim to have recovered from the Chert-Phosphorite Member of the Lower Tal Formation at Maldeota, a number of simple cone type conodonts and Paraconodont-like phosphatic microfossils. The forms recovered include *Cordylodus ?* sp., *Drepanodus homocurvatus*, *Drepanodus* sp., *Hertzina* sp. etc. This conodont assemblage is restricted within Late Cambrian to Early Ordovician elsewhere. If this claim proves correct it would really be a good contribution in resolving the 'Tal tangle'.

OSTRACODES

The early Mesozoic ostracodes in general and the Triassic in particular are scarcely documented in the Triassic literature. Very little is presently known about the biostratigraphical distribution of the Triassic ostracodes, a fact also recognised by several workers such as Sohn (1968 a, b, 1970), Guha (1980) etc. Hence it is not surprising that in India, too, the ostracodes from the marine Triassics are not well recorded and the biostratigraphical zonation of the Triassics on the basis of ostracodes has not, so far, been possible. However, subsequent to the first record of Lower Triassic ostracodes from Mandakpal (Kashmir) by Sahni and Chhabra (1974 a) a few papers on the occurrence of ostracodes from the Himalayan Triassics have come to light.

I. KASHMIR

Sahni and Chhabra (1974 a) recorded from the Lower Triassic dark bluish grey limestone (*Meekoceras* horizon) at Mandakpal an ostracode assemblage comprising following genera : *Bairdia*, *Monoceratina*, *Judahella*, *Microcheilinella* and *Hungarella* in association with conodont assemblage dominated by *Neospathodus waageni* and *Neogondolella elongata* characterising a Smithian-Spathian age.

Agarwal (1979) recorded for the first time from the rocks, possibly equivalent to 'Khunamuh Formation' of Nakazawa *etal.*, (1975), at Khrew, an ostracode assemblage representing following genera : *Bairdia*, *Monoceratina*, *Judahella*, *Hungarella*, *Cytherella* and *Paracypris*. It is also noticed here that the frequency of microgastropods, micropelecypods and fish microremains suddenly increased at the boundaries of grey limestone and the alternating limestone and shale litho-units of the 'Khunamuh Formation' and also between the top of the 'Khunamuh Formation' and the overlying Nodular limestone, probably due to change in environmental conditions.

Agarwal (1980 a) reported, without naming, an ostracode assemblage, in association with foraminifers, conodonts, micromolluscs and fish microremains, from the lowermost Scythian beds, containing *Anchignathodus typicalis* and *Ellisonia teicherti* conodonts (Sweet, 1970a), at Guryul Ravine. Later on Agarwal (1980 c) reported and illustrated the following ostracode genera from upper part of Lower Triassic (Smithian-Spathian) beds exposed in Guryul Ravine : *Monoceratina* sp., *Judahella* sp., *Bairdia* sp., *Healdia* sp., *Cavellina* sp., *Hungarella* sp., and *Macrocypris* sp.

Agarwal, Singh and Sahni (1979, 1980) reported the occurrence and illustrated a number of ostracode genera, mainly long ranging, from the Lower Triassic rocks at Khrew, Mandakpal and Guryul Ravine. Kozur (personal communication to PNA) found many similarities of this fauna with his Upper Permian ostracode fauna and suggests that the forms identified by Agarwal *et al.*, (1980) as *Paracypris*, *Macrocypris*, *Pontocypris* may belong to *Triassocypris* and *Spinocypris* Kozur and the Monoceratinids to *Praebythoceratina* or to *Paraberounella*.

II. HIMACHAL PRADESH

Goel and Srivastava (1978) reported, but did not describe and illustrate, an ostracode assemblage comprising 11 species from the Anisian biomicrites from Guling, on the right bank of Pin River in Spiti. The forms recorded include : *Monoceratina macoupeni*, *Bairdia angusta*, *B. amygdaliformis*, *B. conolata*, *B. clio*, *B. bulleta*, *B.* aff. *B. wabashensis*, *B. angulata*, *Paracypris* sp., *Polycope pumicosa* and *Amphicythere* sp.

III. KUMAUN HIMALAYA

Gupta and Kachroo (1978) in their review paper mention the occurrence of *Bairdia* sp., *Hungarella* sp., *Monoceratina* sp. *Carinaknightina* sp., *Cavellina* sp. and *Paraparchites* sp. from Anisic-Ladinic sediments of Kumaun, but have not referred to the source of information.

Agarwal (1980 b) reported ostracode genera represented by *Bairdia*, *?Krithe*, *Cytherella*, *Hungarella*, *Monoceratina*, *Polycope*, *Thaumatocypris*, *Bythoceratina*, *?Monsmiralibia*, *?Paleomonsmiralibia*. *Bronsteiniana* and *Primatia*, and some foraminifera from the same sample (T. 55) of the Kalapani Limestone of Malla Johar area from which was recovered conodont fauna by Sahni and Chhabra (1974 b).

Agarwal and Kumar (1981) described and illustrated an ostracode assemblage, referable to 13 genera of 11 families, from the Middle Triassic Kalapani Limestone, Malla Johar area. This ostracode assemblage is interesting as it includes both the Palaeozoic types as well as post-Triassic types and many other long ranging forms. A similar type of peculiarity has also been observed by Sohn (1968 a, 1970) at Salt Range (Pakistan) where he recorded, from Lower Triassic sediments, the ostracodes of both Palaeozoic and post-Triassic affinities and explained this coexistence of the ostracode taxa having Paleozoic affinities with those having post-Triassic affinity due to survival of some Palaeozoic forms from Permian into Triassic and/or even later.

Gupta and Sahni (1980) recorded seven ostracode genera, namely *Hungarella*, *Bairdia*, *Bairdiacypris*, *Paracypris*, *Lutkevichinella*, *Reubenella* and *?Cytherella*, from a marly bed at the base of Upper Triassic Kioto Limestone exposed at the Lungar Jumpa nala of the Chharap Valley at the northeastern corner of Himachal Pradesh. All the recorded forms are long ranging and identified up to generic level, hence they are not of much biostratigraphical importance.

FORAMINIFERA

The foraminifera have played important role on biostratigraphical zonation of Late Mesozoic and younger sediments, but their importance in biostratigraphy of the marine Triassics throughout the world is relatively much less significant. Their record in the marine Triassics are not well documented probably due to their extraction from the parent rock being difficult and also the corroded nature of their shell. However, Bhatt and Joshi (1978 b), Goel and Srivastava (1978) and Azmi (1980 c) from Spiti ; Nakazawa *et al.*, (1975), Tewari *et al.*, (1978), and Agarwal (1981a) from Kashmir; and Gupta *et al.*, (1975), Agarwal (1980 b), Agarwal and Kumar (1980), M.P. Singh *et al.*, (1980) and Agarwal *et al.*, (1981) from Kumaun Himalaya recorded foraminifera from the Himalayan Triassics.

I. SPITI

Bhatt and Joshi (1978 b) recorded assemblage of 8 benthonic foraminifera from a limestone sample of Lower Triassic age, exposed 0.55 metres above the contact of *Productus* shales and the overlying limestone with *Otoceras woodwardi*, on the left bank of Spiti river, about 1.5 Km downstream from the Lingti river confluence in Spiti. The forms recorded include, sepcies of *Ammodiscus*, *Lituotuba*, *Ammodiscoides*, *Ammovertella*, *Bathysiphon*, *Glomospira*, *Glomospirella* and *Usbekistania*.

Goel and Srivastava (1978) recovered from Guling in Spiti following Anisian foraminifrea : *Ammobaculites inconspicud*, *Ammodiscus erugatus*, *A.* aff. *A. erugatus*, *Dentalina korynephora*, *D. collisa*, *D. cassina*, *D. bacculenata*, *Frondicucularia* sp., *Citherinella chamani*, *Nodosaria decoris*, *N. cushmani*, *N. bambusa*, *N. crassula*, *N.* aff. *N. decoris*, *Ammovertella labyrintha*, *A. prodigalis*, *A. undulata*, *Bolivina lathotica*, *Earlandinita* sp., *Lituotuba* sp., *Lituotubella glomospioides*.

Azmi (1980 c) has recorded following foraminifera from different Triassic sections in Spiti : *Ammobaculites errugatus*, *Variostoma crassum*, *V. spinosum*, *Ammovertella labrynthi*, *Lenticulina* sp., *Frondicularia* sp. and *Lituotubella* sp. A detailed account of this work is, however, awaited.

II. KASHMIR

Nakazawa *et al.*, (1975) recorded a single form of *Glomospirella* cf. *shengi* Ho and some undifferentiated rotaliids from the Guryul Ravine in their Khunamuh Formation in Kashmir.

Tewari, Sharma and Gupta (1978) recorded, described and illustrated some Noric microfossils from Upper Triassic limestone exposed near Zamalgam, close to Verinag in Anantnag district Kashmir. The foraminifera recorded include *Ammodiscus* sp., *Variostoma crassum*, *V. spinosum*, *Lenticulina* sp. and *Frondicularia* sp.

Agarwal (1981a) reported occurrence of foraminifera belonging to families Ammodiscidae and Nodosariidae from the Lower Triassics of Khrew, Mandakpal and Guryul Ravine in Kashmir.

III. KUMAUN

Gupta, Zaninetti and Kachroo (1975) described and illustrated with SEM micrographs an assemblage of foraminifrea comprising *Ammodiscus annulinoides*, *Glomospira perplexa*, *?Ammovertella polygyra*, *Ammobaculites eumorphos*, *A.* sp., *Haplophragmoides* sp., *Ophthalmidium* ?sp., *Variostoma cochlea*, *V. crassum*, *?Frondicularia eulimabata*. *Lenticulina* sp., *Astacolus* sp., *Nodosaria* sp., and *Dentalina* sp. from Upper Triassic (Norian) exposed near Kuti in northeastern Kumaun.

Agarwal and Kumar (1980) reported presence of *Ammodiscus* sp., *Lituotuba* sp. and *Glomospira* sp , from the Middle Triassic Kalapani Limestone sample from Kio Valley, Malla Johar region, Uttar Pradesh.

Singh, Kumar, Singh and Singh (1980) recorded and illustrated 8 foraminifera—*Nodosaria* sp., *Glomospira* sp., *Lingulina* sp., *Ammobaculites* sp., *Citharina* sp., *Lituotuba* sp., *Glomospirella* sp. and *Veginulina* sp., from Kuti Shale (Noric), Malla Johar area, Kumaun.

Agarwal, Kumar, Singh and Singh (1981) recorded a rich assemblage of foraminifera, comprising 27 genera belonging to families Ammodiscidae, Nodosariidae, Astrorhizidae, Saccamminae, and Semitextulariidae, from the Middle Triassic Kalapani Limestone (Foramation), containing *Ptychites everesti* Oppel, a typical Upper Anisic ammonite, in Yong Valley, Malla Johar area, Chamoli district, Uttar Pradesh. This well differentiated foraminiferal assemblage is found associate, with conodonts (*Gondolella mombergensis*, *G. navicula navicula G. constricta*, etc.), ostracodes, micromolluscs, holothurian sclerites and microvertebrates. *Gondolella constricta* is a characteristic conodont species of Upper Anisic Stage (Sweet *et al.*, 1970).

Misra *et al.* (1973) in their paper on Triassic conodonts and fish remains from Niti Pass area, Kumaun Himalaya, casually mentioned presence of foraminifera with *Spirillina* predominating.

Gupta and Kachroo (1978) in their review paper, gave a check-list of foraminifera, *Ammodiscus* sp., *Hemidiscus* sp., *Glomospira* sp., *Lituotuba* sp., *Ammovertella* sp. and *Spirillina* sp. from Anisic-Ladinic succession of Kumaun, but no where in the text and/or references the source of information and the exact locality from which the fossils were recovered, has been mentioned. Further (p. 524) is mentioned presence of *Steinsionia* sp. from Rhaetic-Liassic of Kumaun, but no further detail of the locality and/or reference is given.

HOLOTHURIAN SCLERITES

The first published work on the holothurian sclerites from the Triassics of India is by Gupta and Kachroo (1976) who presented an illustrated account of species represented by *Calclamna germanica*, *Calclamnella* sp., *Fissobractites* sp., *?Eocaudina* sp., *Theelia immissorbicula* and *Acanthotheelia* sp. from a marly limestone at the base of Kioto Limestone near Kuti, Kumaun Himalaya.

Chhabra, Sahni and Kumar (1979) recorded a single species, *Acantotheelia anasica*, from the Kalapani Limestone in Malla Johar region, Kumaun Himalaya.

Tewari, Sharma and Gupta (1978) reported the presence of *Theelia* aff. *subcirculata*, *Eocaudina subhexagona*, *Calclamna germanica*, *Acanthotheelia spiniperforata*, *Fissobractites* etc. from the Upper Triassic (Noric) limestone exposed at Zamalgam, near Verinagar in Anantnag district. This is the first record of holothurian sclerites from Kashmir.

Azmi (1980 a, c) reported, for the first time, a large number of holothurian sclerites, represented by *Calclamnella irregularis*, *Calclamna germanica*, *Eocaudina*, *Theelia ladakhiensis* n. sp., *Acanthotheelia spinosa*, *A. spiniperforata*, *A.* sp. A., *Theelia hexacneme*, and *Auricularites arcuatus*, from Triassic limestones of Spiti and Ladakh. The details of this work are, however, awaited.

MICROMOLLUSCS

Casual references of presence of microgastropods and micropelecypods from the Himalayan Triassics have been made in many of the papers which deal with the microfauna, such as conodonts, ostracodes, foraminifera etc., but no detailed paper has, so far, come to light in which even generic identification of the micromolluscs have been attempted.

MICROVERTEBRATES

Although passing references of the occurrence of fish microremains, skeletal fragments etc. are available in many of the papers published on the Triassic microfauna, but only few have dealt with fish microremains in some detail with suitable illustrations. Misra *et al.*, (1973) recorded fish scales, similar to those of *Hybodus* and *Polyacrodus*, and also a solitary teeth bearing specimen from the Anisic limestone, enclosing conodonts and associated microfauna, at Niti Pass region, Painkhanda, Kumaun Himalaya.

Mehrotra, Sahgal and Jangapangi (1980) recorded a large number of fish microremains comprising jaw fragments, isolated teeth, vertebrae, dermal denticles and skeletal remains, belonging to genera *Acrodus*, *Saurichthyes*, *Pleuracanthus* etc., from Early Triassic of Shalshal area in Kumaun.

Sahni and Chhabra (1976) described, from the Lower Triassics of Pastun, Khreuh, Mandakpal and the Guryul Ravine in Kashmir and from Middle Triassics of Niti Pass and Malla Johar areas in Kumaun, an assemblage of fish microremains in the form of isolated jaws, teeth, spines, skull fragments, vertebrae and scales, both placoid and ganoid. These forms have provisionally been assigned to genera *Acrodus*, *Hybodus*, *Gyrolepis*, *Saurichthyes* and *Leiacanthus*.

Tewari *et al.* (1978) described many fish teeth and scales, a few of which belong to Actionopterygian and Elasmobranchii types, from the Noric limestone at Zamalgam, near Verinag in Kashmir.

Gupta and Kachroo (1978, p. 518) mention occurrence of fish scales *Hybodus* and *Polyacrodus* from Anisic-Ladinic sediments of Kashmir but did not give further details.

MICROPLANKTONS

Little is known about the microplanktons from the marine Triassics of India, However, Nautiyal (1975 a, b) has recorded few acritarchs and tasmanitids from the Triassics of Kumaun and Kashmir. Nautiyal and Sahni (1976) also attempted preliminary paleoenvironmental reconstruction of the Lower Triassic argillaceous sequence on the basis of microplanktons in Pahlgam (Kashmir).

Nautiyal (1975 a) reported occurrence of acritarchs and tasminitids from the Triassic sequence near the Niti Pass in Painkhanda, Kumaun. *Leiosphaerida minuta* and *L.* cf. *L. wenlockia* have been recovered from the Upper Triassic limestone with *Belemnites* at Barahoti region, while from a higher horizon, comprising fossiliferous limestones and shales at Chhotahoti region, were recovered *Leiosphaerida* cf. *L. wenlockia* and *Tasmanites* sp. 2.

Nautiyal (1975 b) recorded microplanktons from a thick shale sequence of the Lower Triassic age at the Western bank of Lidar valley in Pahlgam (Kashmir). The forms recorded include *Leiosphaerida minuta, L.* cf. *L. wenlockia* and *L.* sp. 1 (acritarchs) and *Tasmanites* spp. 1 & 2 (Tasmanitids), in association with rich microflora of disaccate pollens.

Nautiyal and Sahni (1976) described the Lower Triassic argillaceous sequence at Pahlgam. This sequence is reported to be rich in the microplanktons and dissaccate pollens. The authors recorded floral assemblage mainly of three basic types : *Klausipollenites*, cf. *decipiens*, *Platysaccus* cf. *P. pipillionis* and *Sulcatisporites sahnii*. They further observed one dominant type of the microplankton assemblage represented by leiospheras that include *Leiosphaerida minuta*, *L.* cf. *L. wenlockia*, *L.* spp. A & B and *Tasmanites* sp. A. According to the authors "the Pahlgam microflora (microfauna) was related to accumulation in a shoreward (or inshore) not apparently enclosed or partly restricted basinal environment. Moreover, a part of the leiosphere population (phytoplankton) of reduced diversity was derived probably from algae inhabiting shoreward (or inshore) waters".

Tewari *et al.*, (1980) recorded from Malla Johar area the fungal and other alete spores and disaccate non-striate pollens from Kuti Shale (Noric) ; the recorded forms include—*Tetraporina* cf. *Platysaccus*, *Klausipollenites* and disaccate non-striate pollens and alete spores from Passage Formation ; *Callumispora*, *Maculatasporites*, *Alisporites*, *Lundbladispora*, *Parasaccites*, *Lophotriletes*, *Lunatisporites* and *Striatopodocarpites* along with aletes from the Kioto (Rhaetic) Limestone.

TRACE FOSSILS

Kumar *et al.* (1977) described Trace fossils, *Laevicyclus* and *Ichnogenus* Form D & E from the Passage Formation and Kioto (Rhaetic) Limestone, Malla Johar area. They also worked out depositional environment, palaeocurrent, structure and lithostratigraphy of the Tethyan sediments from Cambrian to ?Lower Eocene at Malla Johar area.

CONCLUSION AND REMARKS

(i) The occurrences of conodont species have been reported from the Lower, Middle and Upper Triassics of Kashmir, Ladakh, Spiti and Kumaun Himalaya. These recorded conodont taxa have been listed in Table 1.

(ii) The conodont zones established by Sweet *et al.*, (1970) have also been observed in the Lower and Middle Triassics of Kashmir (Sweet, 1970 a; Gupta 1978; Singh *et al.*, 1980); Spiti (Sweet, 1973; Goel, 1977 ; Bhatt and Joshi, 1978 a; and Azmi, 1980 b).

(iii) Middle Triassic conodont assemblages recovered from Niti Pass area (Misra *et al.*, 1973) and Malla Johar region (Sahni and Chhabra, 1974 a) in Kumaun Himalaya correspond to those of Mediterranean-North America and Alpine regions respectively.

(iv) Not much data on the Upper Triassic conodont assemblage is available.

(v) The newly investigated conodont data from the Himalayan Triassics not only correspond to conodont zones of Sweet *et al.*, (1970) but also have close correlation with the well established ammonite zones of Silberling and Tozer (1968). A chart showing the ammonitic zones and corresponding conodont zones in the Triassics has been summarised in Table 4.

(vi) The occurrences of foraminiferal taxa from the Himalayan Triassics have been shown in Table 3. The recorded taxa are long ranging and their significance in biostratigraphy has yet to be established.

(vii) The records of ostracodes, holothurian sclerites, micro-vertebrates and microplanktons from the marine Triassics of India have been condensed in Table 2.

(viii) The ostracodes are gradually attaining biostratigraphical significance and Sohn (1968) has succeeded in differentiating Ladinic and Carnic Stages in Israel on the basis of ostracodes. It has also been observed that *Judahalla* Sohn has, so far, been recorded from the Triassic rocks only (Agarwal, 1981c) and further work on this genera may reveal its importance in demarcating stages and/or zones in the Triassics. However, more detailed study is needed for precise stratigraphic location of the Triassic ostracodes.

(ix) The work on holothurian sclerites, microvertebrates and microplanktons from the marine Triassics is still in preliminary stages and their biostratigraphical significance is relatively less known.

ACCOMPLISHMENTS AND SHORTCOMINGS

The above cited accomplishments in the field of micropalaeontological researches on the marine Triassic rocks of India neither appear lucrative nor look impressive, as there are certain serious impediments in our approach. In majority of the published papers, except those on conodonts, are recorded microfossils from different Triassic localities in the Himalaya. In few papers systematic palaeontology of different groups of microfossils have been described and/or illustrated. But attempts on biostratigraphy, basinal problems, and study of microfacies of the carbonate beds, supplemented by micro-

Table 1. Conodont occurrences in different stages of the Triassic sections in the Himalaya. A cross (×) sign marks the presence of a conodont species in the region against which it is placed. (Based on published data without nomenclatorial changes in genera and species of the conodonts)

CONODONT SPECIES	Kashmir	Ladakh	Spiti	Kumaun
e. RHAETIC-LIASSIC				
Neospathodus hernsteini		×		×
d. CARNIC-NORIC				
Epigondolella bidentata		×		
E. nodosa	×	×		
Paragondolella polygnathiformis	×			
Neocavitella indica		×		
P. navicula steinbergensis		×		
P. navicula navicula	×	×		
Gondolella steinbergensis				×
Metapolygnathus abneptis abnepotis				×
M. abneptis spatulatus				×
M. posterus				×
M. aff. posterus				×
c. ANISIC-LADINIC				
Metapolygnathus polygnathiformis	×	×		×
M. excelsus		×		×
Paragondolella polygnathiformis	×	×	×	×
P. navicula navicula				×
P. navicula	×	×		
P. excelsa	×	×		
Epigondolella mungoensis	×	×		
E. multidentata		×		
E. hungarica	×	×		
E. malayensis	×	×		
E. sp.				×
Neogondolella excentrica		×		
N. mombergensis	×	×	×	×
N. navicula navicula	×	×	×	×
N. constricta				×
N. excelsa		×		
N. huckriedie				×
Didynodella alternata	×	×		
Gondolella constricta				×
G. mombergensis				×
G. navicula				×
G. sp.	×			
Gladiogondolella tethydis	×	×		×
Hindeodella multihamata	×			×
H. triassica	×			×
H. nevadensis				×
H. suevica				×
H. riegeli				×
H. ziegleri				×
H. kiogarensis				×
Cratagnathodus kochi	×			
C. sp.	×	×		
C. posterognathus				×
C. lapthalensis				×
C. mallajoharnesis				×
C. budurovi				×
Cypridodella mülleri	×			
C. spengleri				×
C. medi ocris				×
C. conflexa				×
Lonchodina latidentata	×			
L. sp.	×			×
L. muelleri				×
Prioniodella ctenoides	×			
P. decrescens	×			×
P. libita				×
P. sweeti				×
P. petrae-viridis				×
P. pectiniformis				×
P. erecta				×
P. latidentata				×
P. prioniodeltoides				×
P. prioniodellides				×
Ozarkodina tortilis	×	×		×
O. saginata	×	×		×
O. kockeli				×
O. sp.				×
Oncodella aff. *paucidentata*	×			×
Parachirognathus symmetrica	×			
Diplodella lautissima				×
D. dieneri				×
D. magnidenttata				×
Neospathodus pakistanensis	×			
N. dieneri	×			
N. discretus	×			
N. mosheri				×
Cornudina sp.	×			
C. ?lantidentata				×
Prioniodina latidentata	×			
P. sp.				×
Xaniognathus curvatus	×			
Chirodella erecta				×
C. triquetra				×
Dichodella				×
Roundya latidentata				×
Enantiognathus ziegleri				×
E. petraviridis		×		
E. sp.				×
Xaniognathus newpassensis			×	
b. SCYTHIC				
Hindeodella triassica	×			
Roundya sp.				×
Parachirognathus sp.				×
Neopathodus timorensis			×	
N. kockeli	×			
N. kedahensis	×			
N. traingularis	×		×	
N. spathi	×			
N. homeri	×		×	
Neogondolella jubata	×			
N. elongata	×			
N. triassica	×			
N. nevadensis	×			
Ozarkodina tortilis	×			
Prioniodina latidentata	×			
Enantiognathus ziegleri	×			
Diplododella magnidentata	×			

Table 1—(Contd.)

CONODONT SPESIES	Kashmir	Ladakh	Spiti	Kumaun-
Cypridodella mülleri	×			
C. conflexa	×			
Ellisonia nevadensis			×	
Hibbardella subsymmetrica			×	
Prioniodella prioniodellides			×	
Lonchodina aequarticulata			×	
Neospathodus waageni	×		×	
Platyvillosus costatus			×	
Parachirognathus symmetrica	×			
Ellisonia robusta	×		×	
Neospathodus pakistanensis	×		×	
N. spitiensis			×	
N. cristagalli	×		×	
N. dieneri	×	×	×	×
N. kummeli	×		×	

CONODONT SPECIES	Kashmir	Ladakh	Spiti	Kumaun	Lahaul
Ellisonia teicherti	×		×		
E. gradata	×		×		
Xaniogenathus deflectens			×		
X. curvatus			×		
Neospathodus labiatus			×		
N. novaehollandiae			×		
Ellisonia triassica	×		×	×	
Neogondolella carinata	×	×	×		×
N. planta			×		
Anchignathodus typicalis	×	×	×	×	
a. PERMIAN-TRIASSIC BOUNDARY					
Neogondolella carinata	×	×	×	×	
Ellisonia teicherti	×		×		
Anchignathodus typicalis	×		×		

Table 2. Check list of ostradodes, holothurian sclerites, microvertebrates and microplanktons from Triassics of the Himalaya. A cross sign (×) marks the presence of a fossil form.

Name of fossil specimen	Himachal Pradesh		Kashmir	Kumaun
	Spiti	Other		
OSTRACODES		(Chharap Valley)		
Hungarella.		×		
Bairdia.		×		
Bairdiacypris.		×		
Paracypris.		×		
Lutkevichinella.		×		
Reubenella.		×		
? *Cytherella.*		×		
Monoceratina macoupeni	×			
Bairadia amygdaliformis	×			
B. conilata	×			
B. clio	×			
B. angusta	×			
B. bulleta.	×			
B. angulata	×			
B. aff. *B wabashensis*	×			
Paracypris sp.	×			
Polycope pumicosa	×			
Amphicythere sp.	×			
Bairdia spp.			×	×
Monoceratina spp.			×	×
Judahella spp.			×	
Microcheilinella sp.			×	
Hungarella sp.			×	×
Cytherella spp.			×	×
Paracypris sp.			×	
Macrocypris sp.			×	
Pontocypris sp.			×	
Healdia sp.			×	
Cavellina spp.			×	×
Carinaknightina sp.				×
Paraparchites sp.				×
? *Krithe* spp.				×
Polycope spp.			×	×
Thaumatocypris sp.				×

Name of fossil specimen	Himachal Pradesh		Kashmir	Kumaun
	Spiti	Other		
Bythoceratina sp.				×
? *Monsmiralibia* sp.				×
? *Palaeomonsmiralibia* sp.				×
Bronsteiniana sp.				×
Primatia sp.				×
Aechmina sp.			×	
Cytherelloidea spp.			×	×
Roudyella sp.			×	
Cythereptaron sp.			×	
Krausella sp.			×	
HOLOTHURIAN SCLERITES				
Theelia ladakhiensis	×			
Calclamna germanica	×		×	
Calclamnella irregularis	×			
Eocaudina sp.	×			
Theelia hexacneme	×			
Acanthotheelia spinosa	×			
Ausicularites arcuatus	×			
Theelia immissiorbicula				×
T. aff. *subcirculata*			×	
Acanthotheelia sp.				×
A. spiniperforata			×	
A. anasica				×
Eocaudina subhexgana			×	
Calclamna germinaca			×	×
Calclamnella sp.				×
Fissobractites			×	×
? Eocaudina sp.				×
MICROVERTEBRATES (Fish remains)				
Saurichthyes				×
Hybodus			×	×
H. plicatilus			×	×
H. raricostatus			×	×
Polyacrodus				×

Table 2—(Contd.)

Name of fossil specimen	Himachal Pradesh		Kash-mir	Kuma-un
	Spiti	Other		
Gyrolepis			×	×
Acordus lateralis			×	×
A. substriatus			×	×
Pleuracanthus				×
Actinopterygian type			×	
Elasmobranchii type			×	
MICROPLANKTONS				
Leiosphaerida minuta			×	×
L. wenlocki			×	×
L. sp. 1			×	
Tasmanites sp. 1.			×	
Tasmanites sp. 2.			×	×

Table 3—Foraminiferal occurrences in different Triassic stages in the Himalaya. A cross sign (×) marks the presence of a foraminifera in a region against which it is placed. (Based on published literature)

Name of formanifera taxa	Kashmir	Spiti	Kumaun
a, RHAETAN-LIASSIC			
Steinsionia sp.			×
c. CARNIC-NORIC			
Ammodiscus sp.	×		
Ammodiscus annulinoides			×
Glomospira perplexa			×
G. sp.			×
Haplophragmoides sp			×
Ophthalmidium ? sp.			×
Variostoma cochlea			×
V. crassum			×
V. spinosum	×		×
? *Frondicularia eulimbata*			×
Frondicularia sp.	×		
Lenticulina sp.	×		×
Astacolus sp.			×
Nodosaria sp.			×
Dentalina sp.			×
Lingulina sp.			×
Citharina sp.			×
Lituotuba sp.			×
Glomospirella sp.			×
Veginulina sp.			×
Ammobaculites sp.			×
? *Ammovertella ploygyra*			×
Ammobaculites eumorphos			×
b. ANISIC-LADINIC			
Spirillina			×
Ammodiscus sp.			×
Lituotuba sp.			×
Glomospira sp.			×
Hemidiscus sp.			×
Ammovartella sp.			×
Nodosaria hispida			×
Nodosaria sp.			×
Lenticulina spp.			×
Lagena sp.			×
Falsopalmula subparallela			×
Palmula ? *toulmini*			×
P. spp.			×
Psudarcella sp.			×
Rhizammina sp.			×
Frondicularia ? *phhylloformis*			×
F. sp.			×
F. anaceps			×
Astacolus sp.			×
Robulus sp.			×
Pseudonodosaria sp.			×
Dentalina cf. *beautiformis*			×
Dentalina spp.			×
Bathisiphon sp.			×
Ammobaculites inconspicud		×	
Ammodiscus erugatus		×	
A. aff. *A. erugatus*		×	
A. sp.		×	
Schizammina sp.		×	
Astacolus connudatus		×	
Dentalina orynephora		×	
D. collisa		×	
D. cassina		×	
D. bucculenata		×	
Forndicularia sp.		×	
Citharinella chamani		×	
Nodosaria cushmani		×	
N. decoris		×	
N. bambusa		×	
N. crassula		×	
N. aff. *N. decoris*		×	
Ammovertella labyrintha		×	
A. prpodigalis		×	
A. undulata		×	
Bolivina lathotica		×	
Earlandinita sp.		×	
Lituotuba sp.		×	
Lituotubella glomospiroides		×	
a. LOWER TRIASSICS			
Nodosaria sp.	×		
*Usbekistania*s p.		×	
*Lituotuba*s p.	×	×	×
Glomospira sp.	×	×	×
Bathysiphon sp.		×	
Ammovertella sp.		×	
Ammodiscoides sp.	×	×	
Ammodiscus sp.	×	×	×
Glomospirella cf. *shengi*	×		
Glomospirella sp.		×	

Table 4. Ammonoid and conodont zones in the marine Triassic succession. (Modified after Sweet *et al.* 1970).

SERIES	STAGE	SUB-STAGE	AMMONOID ZONE Siberling and Tozer, 1968 Gazdzicki *et al.* 1979	CONODONT ZONE Mosher, 1970, 1973; Sweet *et al.*, 1970 Gazdzicki *et al.* 1979
UPPER TRIASSIC	Rhaetic	Upper	*Choristoceras marshi*	conodonts present but not diagnostic. *Misikella posthernsteini.*
		Lower	*Choristoceras haueri*	
	Noric	Upper	*Rhadoceras suessi*	22. '*Epigondolella*' *bidebtata*
		Middle	*Himavatites columbianus* *Drepanites rutherfordi* *Juvavites magnus*	21. *Epigondolella*' *multidentata*
		Lower	*Malayites dawsoni* *Mojsisovicsites kerri*	20. '*Epigondolella*' *abneptis*
	Carnic	Upper	*Kalamathites macrolobatus* *Tropites welleri* *Tropites dilleri*	19. '*Paragondolella*' *polygnathiformis*
		Lower	*Sirenites nanseni* *Trachyceras obesum*	18. *Neospathodus newpassensis*
MIDDLE TRIASSIC	Ladinic	Upper	*Paratrachyceras sutterlandi* *Maclearnocereas maclearni* *Meginoceras meginae*	17. '*Epigondlella*' *mungoensis*
		Lower	*Progonoceratites poscidon* *Protrachyceras subasperum*	16. '*Neogondolella*' *mombergensis*
	Anisic	Upper	*Gymnotoceras chischa* *Gymnotoceras deleeni*	15. '*Neogondolella*' *constricta*
		Middle	*Anagymnotoceras varium*	14. '*Neogondolella*' *regale*
		Lower	*Lenotropites caurus*	
LOWER TRIASSIC (SCYTHIC)	Spathian		*Keyserlingites subrobustus* *Olenikites pilaticus*	13. *Neospathodus timorensis* 12. '*Neogondolella*' *jubata* 11. 10. *Platyvillosus*
	Smithian		*Wasatchites tordus* *Euflemingites romunderi*	9. '*Neogondolella*' *milleri* 8. *Neospathodus conservativus* 7. *Parachirognathus* 6. *Neospathodns pekistenansis*
	Dienerian		*Paranorites sverdrupi* *Proptychites candidus*	5. *Neospathodus cristagalli* 4. *Neospathodus dieneri* 3. *Neospathodus kummeli*
	Griesbachian	Upper	*Pachyproptychites strigatus* *Ophiceras commune*	2. '*Neogondolella*' *carinata* ? - - - - ? - - - - ? - - - ? - - - -
?PERMIAN		Lower	*Otocereas boreale* *Otocereas concavum*	1. *Anchignathodus typicalis* *Gondolella orientalis-G-subcarinata* A. Z. (Bando *et. al.* 1980 & Bhatt *et al.* 1980).

palaeontological data, are long overdue. Precise identification and accurate stratigraphic location of the microfossils is of utmost importance in biostratigraphical zonation and allied problems. A joint venture of micropalaeontologists, geochemists, and sedimentologists in this direction may prove fruitful in bringing to light many unknown facts and applications of the microfossils, not only in the field of geology but also in many applied sciences, agriculture and industry (Agarwal, 1981b).

The Triassic ostracodes need detailing both taxonomically as well as biostratigraphically before their significance in correlation and interpretation of paleoenvironment could be precisely worked out. Guha (1980) suggested study of their sex ratio (percentage of male and female individuals) for local correlation ; percentage of larval and adult shell for interpretation of environment ; and study of degree of pyritisation, percentage of open and closed valves, degree of sorting of immature and mature forms, percentage of left and right valves and degree of compaction of valves etc. in accurate interpretation of microenvironment.

Some attention on the problems faced in study of the Triassic microfossils also needs focussing. The marine Triassic sediments comprise mainly the limestones, shales and dolomites, from which the microfossils can generally be extracted by acid etching thus the recovered fossils are fragile, poorly preserved and corroded. A precise identification to specific level, with the exception of the conodonts which are comparatively better preserved, is rather difficult. Staining and microphotography of such forms is equally arduous.

It is necessary to evolve new methods of maceration of the Triassic sediments in order to recover the microfossils in better state of preservation and then it would be possible to undertake their detailed morphological and ultrastructural studies to work out precisely their phylogeny, phenotypic variation and correct identification up to specific level, which, in turn, would be helpful in better understanding of their trends of evolution and reconstruction of paleoenvironment.

Recently steps have been taken to study evolutionary pattern in platform conodonts by Clark and Mosher (1966), Mosher (1968) and Budurov and Gupta (1980). Some work has also been done in the direction of study of palaeoecology of the conodonts (Müller, 1962 ; Seddon and Sweet, 1971 and Kozur, 1976 etc.). Unfortunately in India the conodontologists have not shown any progress in this direction in spite of their stratigraphical value.

ACKNOWLEDGEMENT

Dr. H. Kozur (East Germany), Dr. I. G. Sohn (U.S.A.) and Prof. V. J. Gupta (Chandigarh) and all other palaeontologists working on the Triassics deserve our sincere thanks for providing reprints of many of their useful papers, without which this work would have been not possible. One of the authors (PNA) is grateful to Dr. H. Kozur and Dr. I. G. Sohn for their comments on the ostracodes worked out by him and to Profs. B. S. Tewari S. B. Bhatia and A. Sahni of Panjab University, Chandigarh for their valuable suggestions from time to time. He is further indebted to Prof. K. P. Vimal and Drs. S. Kumar, M. P. Singh and I. B. Singh of this department, Messrs. M. V. A. Sastry, H. M. Kapoor and D. K. Bhatt of the Geological Survey of India and Mr. D. K. Guha of the Oil and Natural Gas Commission for fruitful discussions during the preparation of this work.

REFERENCES

Agarwal, P. N. 1979. Scythian ostracodes from 'Khunamuh Formation, Khreuh, Kashmir. *Curr. Sci.* **48**(10) : 442-443.

Agarwal, P. N. 1980a. On the occurrence of Scythian ostracodes from Guryul Ravine, Kashmir. *Proc. 67th Sess. Indian Sci. Cong. Asso., Calcutta*, Pt. III, Sec. V(17) : 50. (Abstract).

Agarwal, P. N. 1980b. A record of ostracodes and foraminifera from Kalapani Limestone, Malla Johar, Kumaun Himalayas. *Proc. 67th Sess. Ind. Sci. Cong. Asso., Calcutta* Pt. III, Sec. V(18): 50-51. (Abstract).

Agarwal, P. N. 1980c. A record of Lower Triassic ostracodes from Guryul Ravine, Kashmir. *Geosci. Jour.* **1**(1) : 93—94.

Agarwal, P. N. 1980d. A record of conodonts from Early Lower Triassic rocks of Mandakpal, Kashmir Himalaya. *Curr. Sci.* **49**(19) : 742-743.

Agarwal, P. N. 1981a. On the occurrence of smaller foraminifera from Lower Triassic rocks, Kashmir Himalaya. *Proc. 68th Sess. Indian Sci. Cong., Varanasi.* Pt. III. Sec. II (**8**) : 4 (Abstract).

Agarwal, P. N. 1981b. An account of micropalaeontogical investigations of the marine Triassic rocks of India. *Proc. Seminar on Himal. Geol. and Palaeontol., Chandigarh.* Sec. II (Abstract No. 24) : 21.

Agarwal, P. N. 1981c. On the occurrence and possible utility of ostracodes in biostratigraphy of marine Triassic rocks, with special reference to *Judahella* Sohn. *Proc. IX Ind. Colloq. Micropal. and Stratigr., Udaipur* : (Abstract).

Agarwal, P. N. and Kumar, S. 1980. Middle Triassic ostracodes and foraminifera from Kalapani Limestone Chamoli district. Tethys Himalayas, Uttar Pradesh. *Sci. and Cult.* **46** (12) : 425-426

Agarwal, P. N. and Kumar, S. 1980. An ostracode assemblage from the Kalapani Limestone, Malla Johar area, Kumaun Himalayas, Uttar Pradesh. *In.* : A. K. Sinha (Ed.) *Contemporary Geoscientific research in Himalaya*, **1** :

Agarwal, P. N., Kumar, S., Singh, I. B. and Singh, S. K., 1981 A foraminferal assemblage from the Kalapani Limestone (Formation), Malla Johar area, Kumaun Himalayas, Uttar Pradesh. *Proc. IX Ind. Colloq. Micropal. and stratigr., Udaipur.* (Abstract).

Agarwal, P. N., Singh, S. N. and Sahni, A. 1979. Scythian ostracodes from the 'Khunamuh Formation' of Mandakpal and Khreuh, Kashmir Himalayas. *Proc. VI Seminar Himal. Geol. and Palaeontol.*, Centre Adv. Sutd. in Geol., Panjab Univ., *Chandigarh.* 1:1. (Abstract).

Agarwal, P. N., Singh, S. N. and Sahni, A. 1980. Scythian ostracodes from Kashmir Himalayas. *Jour. Pal. Soc. India.* **23-24** : 110-114.

Azmi, R. J. 1980a. Holothurian sclerites from the Triassics of Spiti and Ladakh Himalaya. *Proc. VIII Indian Coll. Micropal. and Strati. M. S. Univ., Baroda.* (Abstract) : 30.

AZMI, R. J. 1980b. Some observations on the Lower and Middle Triassic conodont biostratigraphy of Spiti, Himachal Pradesh. *Proc. XI Himal. Geol. Seminar., Dehradun.* (Abstract No. 4) : 3-4.

AZMI, R. J. 1980c. Biostratigraphy of the Tethyan sediments of Spiti basin. *In : Annual Report, Wadia Instt. Himal. Geol., Dehra-Dun.* (For 1979-1980) : 10-12.

AZMI, R. J., JOSHI, M. N., AND JUYAL, K. P. 1980. Discovery of the Cambro-Ordovician Conodonts from the Mussoorie Tal phosphorite and its significance in correlation of Lesser Himalaya. *XI Himal. Geol. Seminar, Dehra Dun.* (Abstract No. 6) : 4-5.

BANDO. Y., BHATT, D. K., GUPTA, V. J., HAYASHI, Sh., KOZUR, H., NAKAZAWA, K. AND WANG' Z., 1980. Remarks on conodont zonation and stratigraphy of the Permian. *Recent. Res. Geol.* **8 :** 1-53. Hindustan Publishing Corpn. Delhi. 110007.

BENDER, H., 1968. Zur Gliederung der Mediterranen Trias II. Die conodontenchronologie der Mediterraanen Trias. *Ann. Geol. Pays. Helléniques.* **19 :** 465-540, 5 pl. 9 figs.

BHATTACHARYA, D. P., DATTA, R. K. AND SINGH, S. 1971. Geological mapping in parts of the Chamba district, Himachal Pradesh, *Unpublished report of the Geol. Surv. India.*

BHATT, D. K., FUCHS, G., PRASHARA, K. C., KRYSTYN, L. ARORA, R. K. AND GOLEBIOWSKI, R. 1980. Additional ammonoid layers in the upper Permian sequence of Spiti. *Bull. Ind. Geol. Assoc.*, **13**(1) **:** 57-61.

BHATT, D. K., AND JOSHI, V. K. 1978a. Early Lower Triassic conodonts from Spiti river section. *Curr. Sci.* **47**(4) : 118-120.

BHATT, D. K. AND JOSHI, V. K. 1978b. A record of foraminifera from the Lower Triassic strata of Spiti. *Curr. Sci.* **47**(10) : 346.

BHATT, D. K., JOSHI, V. K. AND ARORA, R. K. 1980a. *Neospathodus paraekummeli*—a new species of conodont from Lower Triassic of Spiti. *Proc. VIIII Indian Coll. Micropal. and Stratigr.*, M. S. Univ., Baroda. (Abstract). : 3-4.

BHATT, D. K., JOSHI, V. K. AND ARORA, R. K. 1980b. Conodonts in the *Otoceras* bed of Spiti. *XI Himal. Geol. Seminar, Dehra-Dun*, (Abstract No. 13) : 8-9.

BUDUROV, K. AND GUPTA, V. J. 1980. Generalised evolutionary developments in Triassic platform conodonts. *XI Himal. Geol. Seminar, Dehra Dun.* (Abstract No. 14) : 9.

BUDUROV, K. AND STEFENOV, S. A. 1973. Etliche neue Plattform-conodonten aus der Mittleren Trias, Bulgariens. *Comptes. rendus de L' Academie bulgare des Sciences.* **26**(6) : 803-806.

CHHABRA, N. L. 1977. Geology and micropalaeontology of certain Triassic sections of Kashmir and Kumuan Himalayas. *Unpublished Academic Thesis, Lucknow University, Lucknow.*

CHHABRA, N. L., SAHNI, A. AND KUMAR, S. 1973. Middle Triassic conodonts from Malla Johar, Tethys Himalaya. *Curr. Sci.* **42** (22) **:** 806-807.

CHHABRA, N. L., SAHNI, A. AND KUMAR, S. 1979. A record of holothurian sclerites from the Triassic of Malla Johar, Kumaun Himalaya. *Curr. Sci.*, **48**(23) : 1038-1039.

CLARK, D. L. AND MOSHER, L. C. 1966. Stratigraphic, geographic and evolutionary development of the conodont genus *Gondolella. Jour. Pal.* **40 :** 376-394.

DATTA, R. K. AND SINGH, S. 1973. Geology of parts of Chamba district, Himachal Pradesh. *Unpublihed report. Geol. Surv. India.*

DIENER, C. 1912. Trias. of the Himalayas. *Mem. Geol. Surv. India.* **36**(3) **:** 1-175.

DIENER, C. 1913. Triassic faunae of Kashmir. *Pal. Ind., N. S.* 5, *Mem.* **1 :** 1-133.

GANSSER, A. 1964. *Geology of Himalayas.* Intersci. Publ. Lond. 289 p.

GAZDZICKI, A. , KOZUR, H. AND MOCK, R. 1979. The Norian-Rhaetian boundary in the light of micropalaeontological data. *Geologija-Razprave in Porocila* 22. *knjiga.* **1 :** 71-112.

GOEL, R. K. 1977. Triassic conodonts from Spiti, Himachal Pradesh, India. *Jour. Pal.* **51** (6) **:** 1085-1101.

GOEL, R. K. AND SRIVASTAVA, S. S. 1978. Anisian microfossils from Guling, Spiti. *Nat. Geog. Jour. India.* **24**(3-4) **:** 159-162.

GRIESBACH, C. L. 1880. Palaeontological notes on the Lower Trias of the Himalayas. *Rec., Geol. Surv. India* **13**(2) : 94-115.

GUHA, D. K. 1980. A review of the work on Mesozoic Ostracoda in India. *In :* Symposium on *Three decades of developments in Palaeontology* and *Stratigraphy in India.* Geol. Surv. India, *Hyderabad.* (unedited and uncorrected preprint).

GUPTA, V. J. 1971. Note on the age of Kalhel Limestone, Chamba district, Himachal Pradesh. *Verh. Geol. B-A* **:** 643-647.

GUPTA, V. J. 1972. Conodonts in the Kumaun Himalayas. *Curr. Sci.* **41**(8) **:** 306.

GUPTA, V. J. 1974a. Permo-Triassic boundary in Himalayas. Die stratigraphie der Alpien-Mediterrane Trias, Wien. *Sch. Erd. Komm. Österr. Akad. Wiss.* **2 :** 97-99.

GUPTA, V. J. 1974b. On the stratigraphic position of Tandi Limestone, Lahaul, India. *Jour. Geol. Soc. India.* **15**(1) **:** 99.

GUPTA, V. J. 1976a. Conodonts from the Himalayas and their stratigraphic implications. *Proc. VI Indian Coll. Micropal. & Stratigr. Varanasi* : 99-121.

GUPTA, V. J. 1976b. Conodont biostratigraphy of the Middle and Upper Trassic rocks of Kashmir and Ladakh. *Himal. Geol.* **6 :** 314-322.

GUPTA, V. J. 1976c. Zur conodonten-stratigraphie der Mittel und Obsertrias des Himalaya. *Österr. Akad. Wiss. Math-naturwiss* Kl., I., 185, **1**(4) **:** 31-41.

GUPTA, V. J. 1976d. The stratigraphic position of Kioto Limestone of Himalayas. *Jour. Geol. Soc. India.* **17**(3) **:** 346-352.

GUPTA, V. J. 1978. Triassic conodonts from the Himalaya and their stratigraphic and paleobiogeographic implications. *Biovigyanam* **4 :** 109-123.

GUPTA, V. J. 1980. Upper Triassic conodonts from northeastern Kumaun Himalayas, India. *Proc. VIII Indian Coll. Micropal. &* Stratigr., M. S. univ., *Baroda,* (Abstract),: 7.

GUPTA, V. J. and BUDUROV, K. J. 1980. A new species of *Neocavitella* from Ladakh, India. *Bull. Ind. Geol. Assoc.* **13** (2) **:** 243-244.

GUPTA, V. J. AND KACHROO, R. K. 1976. Triassic holothurian sclerites from the Kumaun Himalaya *Jour. Ind. Acad. Geosci.* **19**(1) : 43-46.

GUPTA, V. J. AND KACHROO, R. K. 1977. Carboniferous and Triassic conodonts from the Himalayas. *Publ. no.* 11, *Centre Adv. Stud. Geol.* Panjab Univ., *Chandigarh* : 118-129.

GUPTA, V. J. AND KACHROO, R. K. 1978. Recent advances on the Triassic stratigraphy of the Himalayas Pt. I. *In : Recent Researches in Geology* Hindustan Publ. Corpn., Delhi, **5 :** 503-539.

GUPTA, V. J. AND RAFEK, M. 1976. Middle and Upper Triassic conodonts from the Himalayas. *Chayanica geologica.* **2**(2) : 196-214.

GUPTA, V. J. AND SHANI, A. 1980. Upper Triassic ostracodes from the Chharap valley, Lahaul/Ladakh Himalaya, India. *In : Recent researches in Geology,* Hindustan Publ. Corpn., Delhi. **6 :** 687-694,

GUPTA, V. J., ZANINETTI, L. AND KACHROO, R. K. 1975. Upper Triassic foraminifers from northeastern Kumaun Himalayas, India. *Riv. Ital. Paleont.* **83**(1) **:** 1-20.

HEIM, A. AND GANSSER, A. 1939. Central Himalayas (Geological observations of the Swiss expedition, 1936). *Mem. Soc. Helv. Sci. Nat.* 73(1) : 1-246. Reprinted (1975) by Hindustan Publ. Corpn., Delhi.

JOSHI, V. K. AND ARORA, R. K. 1976. On the palaeontological finds in Zanskar area, Ladakh with reference to the Permo-

Carboniferous and Triassic sequence. *Proc. Himal. Geol. Seminar*, Sec. I., New Delhi : 1-9. and also in *Misc. Publ.* No. 41, Pt. I, *Geol. Surv. India* (1979) : 201-208.

KAPOOR, H. M. 1973. On the stratigraphy of Bhadarwah and Bhallaesh, Jammu and Kashmir. *Jour. Pal. Soc. India.* **17** : 55-66.

KOZUR, H. 1976. Paleoecology of Triassic conodonts and its bearing on multielement taxonomy. *Geol. Asso. Canada, Spec. Paper.* 15 : 313-324.

KOZUR, H. AND MOSTLER, H. 1973. Beiträge Zur Mikrofauna Permo-triadischer schichtfolgen Teil I. Conodonten aus der Tibet zone des Niederen Himalaya. (Dolpogebiet, West Nepal). *Geol. Paläont. Mitt. Innsbruck* **3**(9) : 1-23.

KUMAR, S. SINGH, I. B., AND SINGH, S. K. 1977. Lithostratigraphy, structure, depositional environment, paleocurrent and trace fossils of the Tethyan sediments of Malla Johar area Pithoragarh-Chamoli districts, Uttar Pradesh, India. *Jour. Pal. Soc. India.* **20** : 396-435.

KUMMEL, B. 1960. *History of the earth.* Eurasia Publ. House (P) Ltd., New Delhi, 265 p.

MC TAVISH, R. A. 1973. Triassic conodont faunas from Western Australia. *Neub. Jb. Geol. Paläont. Abh.* **143** : (3) 275-303.

MEHROTRA, D. K., SAHGAL, A., AND JANGAPANGI, B. S. 1980. On some fish microremains from the Shalshal area of Kumaun Himalaya Uttar Pradesh. *XI Himal. Geol. Seminar, Dehra Dun,* (Abstract No. 28) : 17.

MIDDLEMISS, C. S. 1909. Gondwanas and related marine sedimentary system of Kashmir. *Rec. Geol. Surv. India.* **37**(4) : 286-327.

MIDDLEMISS, C. S. 1910. A revision of the Silurian-Trias sequence in Kashmir. *Rec. Geol. Surv. India.* **41** : 115-144.

MISRA, R. C., SAHNI, A. AND CHHABRA, N. L. 1973. Triassic conodonts and fish remains from Niti Pass, Kumaun Himalaya. *Himal. Geol.* **3** : 148-161.

MOSHER, L. C. 1968. Evolution of Triassic platform conodonts. *Jour. Pal.* **42**(4) : 947-954.

MOSHER, L. C. 1970. New conodont species as Triassic guide fossils *Jour. Pal.* **44** : 737-742.

MÜLLER, K. J. 1962. Taxonomy, evolution and ecology of conodonts. *In* R. C. Moore (ed.) *Treatise on invertebrate Palaeontology,* Part W, Miscellanea, *Geol. Soc. Am.* and *Univ. Kansas Press :* W 83-W 91.

NAKAZAWA, K., BANDO, Y. AND MASTUDA, T., 1980. The *Otoceras woodwardi* Zone and the time gap at the Premian/Triassic boundary in East Asia. *In :* T. Kobayashi, R. Toriyama, W. Hashimoto and S. Kanno (Eds.) *Geology and Palaeontology of Southeast Asia.* **XXI** : 75-90.

NAKAZAWA, K., KAPOOR, H. M., ISHII, K., BANDO, Y., OKIMURA, Y., AND TUKUOKA, T. 1975. The Upper Premian and Lower Triassic in Kashmir, India. *Mem. Fac. Sci., Kyoto Univ. Ser. Geol. and Mineral* **XLII** (1) : 1-106.

NAUTIYAL, A. C. 1975a. Microplanktons from Tethyan sequence of Niti Pass, Kumaun Himalayas, India. *Curr. Sci.* **44**(22) : 608-609.

NAUTIYAL, A. C. 1975b. Report of microplanktons in the Lower Triassic rocks of Pahlgam, Kashmir, India. *Curr. Sci.* **44**(23) : 853-854.

NAUTIYAL, A. C. AND SAHNI, A., 1976. Lower Triassic argillaceous sequence of Pahlgam (Kashmir Himalaya) and paleoecological observations. *Proc. Nat. Sci. Acad Pt. A* **42** (5) : 364-371.

RAINA, B. K., ALOK, B. K., AND SUNDARAM, R. 1971. On the discovery of Permo-Triassic fauna in the Bhallesh area, Bhadarwah Tehsil, Doda district, Jammu and Kashmir. *Seminar, Recent studies in the Himalayas, Geol. Surv. Ind.* : 11. (Abstract).

RATTAN, S. S. 1973. Stratigraphy and sedimentation of the Chamba area, western Himachal Pradesh. *Himal. Geol.* **3** : 231-248.

SAHGAL, A., MEHROTRA, D. K. AND JANGAPANGI, B. S. 1980. A record of some conodonts from the *Otoceras* Zone of Shalshal area, Kumaun Himalaya, Uttar Pradesh. *XI Himal. Geol. Seminar, Dehra Dun.* (Abstract No. 37) : 23.

SAHNI, A. AND CHHABRA, N. L. 1974a. A record of Triassic ostracodes from Kashmir. *Curr. Sci.* **43**(10) : 325.

SAHNI, A. AND CHHABRA, N. L. 1974b. Middle Triassic conodonts from the Kalapani Limestone, Kumaun Himalayas. *Himal. Geol.* **4** : 259-295.

SAHNI, A. AND CHHABRA, N. L. 1976. Micro fish remains from certain Triassic sections in the Kashmir and Kumaun Himalayas. *Proc. VI Coll. Micropal & Stratigr., . Varanasi* : 218-224.

SAHNI, A. AND PRAKASH, I. 1973. Rhaetic conodonts from Niti Pass, Kumaun Himalayas. *Curr. Sci.* **42**(6) : 218.

SASTRY, M. V. A. AND VERMA, K. K. 1976. On the occurrence of Ladinic Stage in the Kashmir Himalayas. *Seminar Himal. Geol., New Delhi,* Sec. I. : 55(Abstract).

SEDDON, G. AND SWEET W. C. 1971. An ecologic model for conodonts. *Jour. Pal.* **45**(5) : 869-880.

SHAH, S. K., AND SINHA, A. K. 1976. Stratigraphy and Tectonics of the 'Tethyan' zone in a part of western Kumaun Himalayas. *Himal. Geol.* **4** : 1-27.

SILBERLING, N. J. AND TOZER, E. T. 1968. Biostratigraphic classification of the marine Triassic in North America *Geol. Soc. America, Spec. Paper* **110** : 63 p.

SINGH, M. P., KUMAR, S., SINGH, I. B. AND SINGH, S. K. 1980. A record of Triassic foraminifera from the Kuti Shale (Noric), Kumaun Himalaya Uttar Pradesh. *Geosci. Jour.* **1**(1) : 89-91. fig. 1.

SINGH, S. N. AND AGARWAL, P. N. 1980. Early scythian conodonts from *Glyptophiceres* bearing limestone at Mandakpal, Kashmir, Himalaya. XI. *Himal. Geol. Seminar, W.I.H.G., Dehra Dun.* (Abstract) : 31.

SINGH, S. N., CHHABRA, N. L. AND AGARWAL, P. N. 1980. Spathian conodonts from Guryul Ravine, Srinagar district, Kashmir, *Proc. VIII Indian Coll. Micropal & Stratigr. M. S. Univ. Baroda,* (Abstract) : 23.

SOHN, I. G. 1968a. Relict Paleozoic ostracodes in Early Triassic time. *Geol. Soc. America. Prog. Ann. Meetings:* 286-287 (Abstract).

SOHN, I. G., 1968b. Triassic ostracodes from Makhtesh Ramon, Israel. *Bull. Isreal Geol. Surv.* (**44**) : 1-71.

SOHN, I. G. 1970. Early Triassic marine ostracodes from the Salt Range and Surghar Range, West Pakistan. *In :* Kummel, B. and Teichert, C. (Eds.) *Stratigraphic Boundary Problems : Permian and Triassic of West Pakistan.* Dept. Geol. Univ. Kansas, Spec. Publ. 4, Univ. Press Kansas : 193-206.

SRIVASTAVA, J. P. 1974. Conodonts from Carboniferous and Permian rocks of Kashmir valley and from the phosphate zone of Mussoorie, U. P. *Publ. no.* **10**, *Centre Adv. Study in Geol. Punjab, Univ* : 109-111.

SRIVASTAVA, J. P., and MANDWAL, N. K. 1966. First record of conodonts from India *curr. Sci.* **35** (24) : 621-622

SWEET, W. C. 1970a. Permian and Triassic conodonts from a section at Guryul Ravine, Vihi district Kashmir. *Kansas Univ., Pal. Contr.* **49** : 1-10.

SWEET, W. C. 1970b. Uppermost Premian and Lower Triassic conodonts of the Salt Range and Trans-Indus ranges, West Pakistan. *In :* Kummel, B & Teichert, C. (Eds.) *Stratigraphic Boundary Problems, Permian and Triassic of West Pakistan.* Geol. Dept., Kansas Univ., Spec. Publ. (4) : 207-269.

SWEET W. C. 1973. Late Permian and Early Triassic conodont faunas. *In :* Logan, A. and Hills L. V. (Eds.) *The Permian and Triassic System and their mutual boundary. Canad. Soc. Petrol. Geol. Spec. Publ.* **2** : 630-646.

SWEET W. C., MOSHER, L. C. CLARK, D. L., COLLINSON, J. W. AND HASSENMULLER, W. A. 1970. Conodont biostratigraphy of the Triassic. *In :* W. C. Sweet and S. Bergstrom (Eds.) *Symposium on conodont biostratigraphy. Mem. Geol. Soc. America.* **127 :** 441--465.

TEICHERT, C. 1968. *Palaeontology* McGraw-Hill Year Book, Sci. and Tech. : 286-287.

TEWARI, B. S. SHARMA, V. AND GUPTA, V. J. 1978. Noric microfossils from Zamalgam near Verinag, Anantnang district, Kashmir. *Himal. Geol.* **8**(1) **:** 108-118.

TEWARI, R. S. TRIPATHI, A., KUMAR, S., SINGH, I. B., AND SINGH, S. K. 1980. Gondwana plant microfossils from the Tethyan sediments, Malla Johar area, Uttar Pradesh. *Jour. Pal. Soc. India.* **23-24 :** 39-42.

TIPINS, R. S. 1980. Current status of conodont research. *Proc.* III *Indian Geol. Cong., Poona* (Abstract) : 2-3.

TOZER, E. T. 1967. A standard for Triassic time. *Bull. Geol. Surv. Canada.* **156 :** 1-103.

TOZER, E. T. 1978. Review of the Lower Triassic ammonoid succession and its bearing on chronostratigraphic nomenclature. *In :* Zapfe, H. (Ed.) *Briträge zur biostratigraphie der Tethys-Trias. Österr. Akad. Wiss. Schrift. Erdwissen, Komm.,* **4 :** 21-36.

VERMA, K. K. AND SASTRY, M. V. A. 1963. On the Triassic succession at Pastun, Kashmir. *Proc.* 50*th Sess. Ind. Sci. Cong.* Pt. 3. 279-280. (Abstract).

WADIA, D. N. 1975. *Geology of India.* IV Ed., Tata McGraw Hill Publ. Co., New Delhi., 508 p.