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Indian Marine Triassic and Related Problems*)

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Abstract

The Triassic of the Tethys realm, exposed in the Himalaya of India and adjoining Nepal and Bhutan, is briefly reviewed. The summary of the results of the

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recent studies on the Lower Triassic of Kashmir is presented. The boundary between the Upper Permian and the Lower Triassic in Kashmir is nearly resolved; however, the boundaries between Lower and Middle Triassic and between Norian and Rhaetian in the entire Himalayan belt are not clear. The controversial Triassic beds are briefly discussed and a new stratigraphical scheme is proposed.

Introduction

The marine Triassic rocks of India and adjoining parts of Nepal and Bhutan, forming an about 1200 metres thick sequence of limestone and shale, developed within a broad fossiliferous belt of Cambrian to Cretaceous strata from Kashmir to eastward — in a more than 2000 kilometre stretch of Himalaya (Extra-Peninsula), is a system of Tethys realm (Text Figure 1 A and B). It includes a continuously deposited sedimentary series of the Himalayan facies and isolated exotics of the Tibetan facies. Among marine Triassic, volcanics and plant beds are also known in the western part of the Himalayan belt. Another marine series of Himalayan facies in Assam region, consisting of slate, sandstone and quartzite, has been compared with the Axial Group of Burma (= Halobia Limestone, Carnic).

The lower sections of the Himalaya show a different marine formation of dolomite and limestone from Jammu to Nepal — a part of which on palynological interpretations, has been presumed to be Triassic. Other parts of India have also well developed Triassic strata with a vertebrate fauna and flora of Gondwana System and are of continental type.

The paper will therefore be confined to the strata of the Tethys realm of Himalaya, which is important for Triassic stratigraphy due to (a) abundance of fossils forming the basis of classification in Asiatic region, (b) its wide geographical extent and well documented sections, divisible into stages, substages and zones characterised by distinct faunas and (c) its median position between Alpine Triassic of Europe and the Triassic of East and Far East. The Himalayan Triassic, besides this importance, imposes difficulties of working due to their geographical position in difficult terrains, tectonism, abrupt facies changes and condensation of beds etc.

Figure 1 ➤

The marine Triassic of India, Nepal and Bhutan

1A —	Kashmir region	(A)	Bhallesh region	(B)
	Chamba region	(C)	Tandi region	(D)
	Zanskar region	(E)	Spiti region	(F)
	Central Himalayan region	(G)		
1B —	Nepal region	(H)	Sikkim region	(I)
	Bhutan region	(J)		

1. Pir Panjal	2. Guryul ravine	3. Pastannah
4. Bhallesh	5. Kalhel	6. Tandi
7. Chharap	8. Lilang	9. Bambanag and Shalshal Cliff
10. Tinkar Lipu	11. 'Exotic Blocks'	

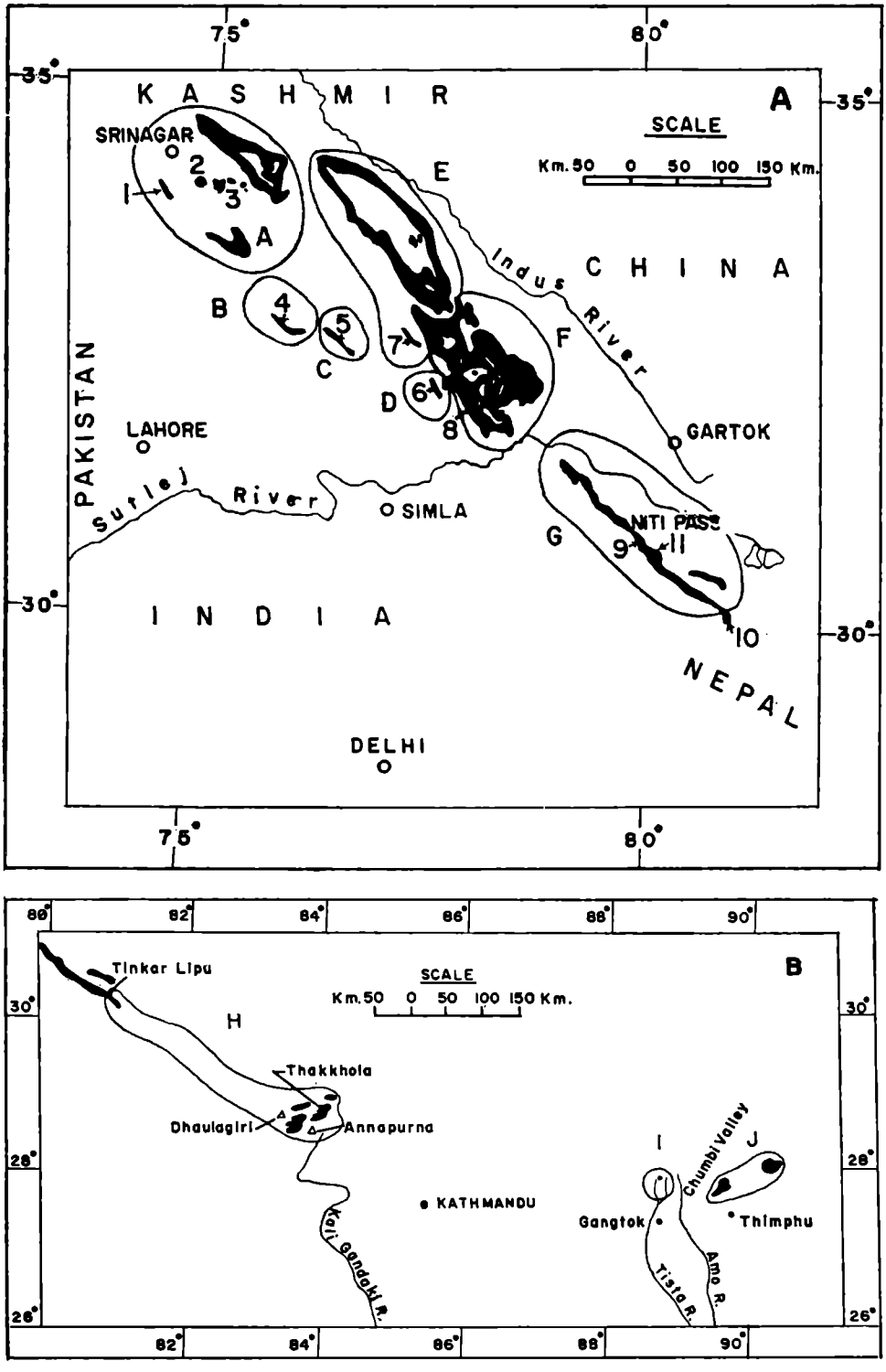


Figure 1 A and B

The Himalaya falling within the territories of India, Nepal and Bhutan have been described in Triassic literature as Kashmir, Zanskar, Spiti, Central Himalaya, Nepal, Sikkim and Bhutan regions. The Kashmir region is important for it is easily approachable, tectonically less disturbed and bears thick Lower Triassic sections. The Zanskar region is signified only by its stratigraphy from various localities suggesting its continuity with the Spiti-region; the fossils representing various stages are also known, but all are distributed records. The Spiti region and the Central Himalayan region include a number of classical sections from where significant faunas were first discovered. The Nepal region shows two well developed Triassic areas. One at its northwestern corner and the other in the central part, former being the continuity of the central Himalaya. The details of the Triassic of Sikkim and Bhutan regions are still in a rudimentary stage of knowledge.

In addition, the recent surveys have brought to light a number of new records of Triassic beds from Himalayan sedimentary and metasedimentary rocks, which were previously considered as early Palaeozoic. These have been described here under Bhallesh, Chamba and Tandi regions. It includes the new finds of Permo-Triassic strata and fauna which occupy a position south of the Central Himalayan Crystalline Axis. This is in contradiction with the existing concept, that in general the fossiliferous marine beds are confined only to the north of the axis; the only exception being Kashmir (*i. e.* Kashmir nappe).

The brief review of the Triassic stratigraphy of different regions, given in the following pages also include the related problems. In the description of the Kashmir region, however, a summary of the results of latest researches on the Lower Trias is also given.

Kashmir region

The continuous Triassic sequence of Kashmir valley, has been referred historically as Kothiar beds and Supra-Kuling. The systematic record however, emerges from the contributions of Middlemiss (1909, 1910, 1911), Wadia (1928, 1934) with palaeontology by Diener (1913). These workers divide the Kashmir Triassic System into Lower, Middle and Upper. They considered Middle Triassic to be a series of shale and limestone, the Lower and the Upper Trias being of limestone only.

The Kashmir region exhibits a number of sections where Permian beds gradually pass into the Lower Triassic beds; as such is an important region to study the Permian-Triassic biological crisis. The latest studies by Prof. Nakazawa of Kyoto University with a team of Indian and Japanese geologists, have shown its superiority over the other sections of the globe. The Guryul ravine section, a stratotype for Upper Permian — Lower Triassic transition, covers nearly all well-defined stages of Upper Permian and of the lower division of the Lower Triassic without any hiatus. The upper division of the Lower Triassic is also likely to be present in unexplored thick strata, making it possible to establish an ideal section for complete Lower Triassic. The team has therefore, not ventured to propose subdivisions of the Lower Triassic in Kashmir and believes after researches in the upper division, the Guryul

ravine section will offer an ideal stratotype for the Lower Triassic of Peri-Gondwana. In their opinion Abadeh in Central Iran and presumably the Lower Triassic of South China, may represent a standard for the Tethys realm. The Guryul ravine section is also superior to the traditional Salt Range sections, in having accepted basal *Otoceras woodwardi* Zone, so far unknown in Pakistan and absence of any hiatus, which is marked in Salt Range by a paraunconformity. These workers also believe, in using the term 'Scythian' for Lower Triassic, introduced to this part by NOETLING (1905) and now commonly used by geologists, to have some reservations; because the type Scythian (Mt. Bogdo to the north of the Caspian Sea) includes only one or two ammonoid zones, corresponding to the *Tirolites* Zone of Southern Alps; while the entire Lower Triassic contains at least ten ammonoid zones.

The Middle Triassic (Anisian or Muschelkalk) includes only representative sections at Guryul ravine, Khreuh and Pastannah (= Pastun); five local zones have been inferred in it by MIDDLEMISS (1910) but they collectively show only Upper Anisian age (*Paraceratites trinodosus* Zone of Paraceratitan age of Spath, 1934 corresponding to the Upper Anisian substage of TOZER, 1974 in his three fold division of Anisian stage). The collection of MIDDLEMISS comes from the younger layers of supposed Middle Trias, for which DIENER (1913) thought that the boundary of the Lower und Middle Triassic may be an arbitrary and that Middle Triassic in the lower horizons may include a part of the Lower Triassic; he also believed that Kashmir sections may have Lower Anisian fauna in the beds not so far examined for fossils. The base of the Middle Triassic has previously been considered below the layers bearing *Retzia himaica* and *Rhynchonella griesbachi* in other Himalayan sections, this view had the added support from the younger bed (*Durgaites dieneri* bed) which is supposed to have Middle Triassic fauna.

The Ladinian, previously considered to be absent in this region, has now been recognised by VERMA and SASTRY (1963) in Pastannah section by reporting species of *Daonella*, in shale and limestone (Lamellibranch Zone, uppermost layers of Middle Triassic). This is supposed to be Ceratitan in age.

It is therefore evident, that the 150 metres thick strata of the Middle Triassic of Kashmir, have no sufficient palaeontological data at present to subdivide them into various zones, stages and substages.

The Upper Triassic of Kashmir region, is only a lithologically defined stratum with very little support of fauna. Its position between beds with Jurassic fauna and a Ladinian bed confirms only the Upper Triassic time. A few records of the Upper Triassic bivalves, brachiopods, gastropods, corals and algae from widely scattered areas are important only for local correlation. It is rather strange that ammonoid or bivalve fauna in Kashmir is so scanty, whereas it is profuse in other Himalayan sections. Whether it is only the lack of search or the absence is attributable to geological factors, will only be proved by future work.

Permo-Triassic boundary in Kashmir: The uninterrupted Permian to Triassic succession was known in Kashmir since the work of HAYDEN (1907) in the Guryul ravine section. He concluded the boundary between beds bearing *Marginifera himalayensis* and dark shales. In the Lower Triassic, he postulated beds up to *Hedenstroemia* bed. His inference of Middle Triassic was modified by MIDDLEMISS

(1909, 1910). MIDDLEMISS while revising this section could not find any diagnostic fossil or feature to support HAYDEN, and modified the boundary below the Cliff limestone, by virtue of the lithological division. The Cliff limestone is overlain by Meekoceras bed (MIDDLEMISS presumed it to be true Himalayan Meekoceras bed but now established Owenitan or Smithian Meekoceras bed). WADIA (1961) on the other hand regards the boundary just below Meekoceras bed (Figure 2).

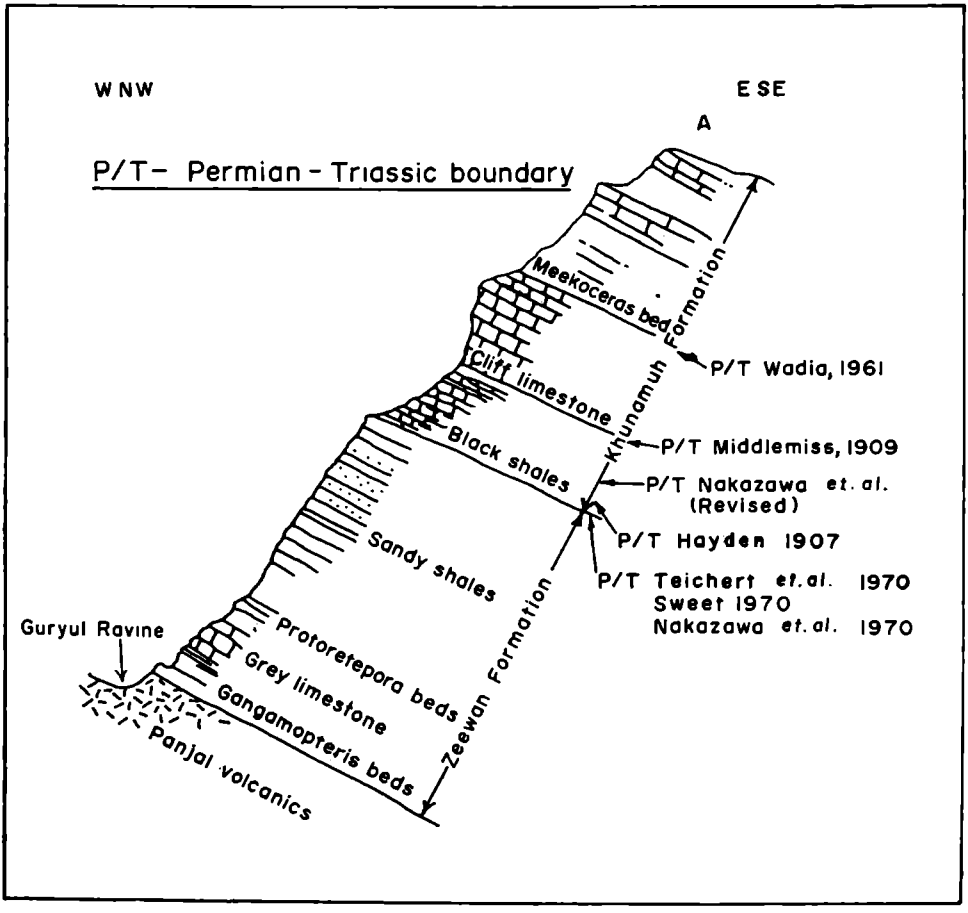


Figure 2

Guryul ravine section, Kashmir (After MIDDLEMISS, 1909).

The other section of importance for this problem is that of Pastannah after the work of MIDDLEMISS (1910). The so called Ophiceras bed represented the oldest Triassic bed in Kashmir. DIENER (1913), on fossil examination of this bed could not concile to consider the '*Ophiceras*' fauna to be similar to the *Ophiceras* fauna of the Himalayan sections but regarded it to be almost para-contemporaneous in nature.

The recent studies by KAPOOR (in MCTAVISH and DICKINS, 1974) have now proved that the so called 'Ophiceras' bed is actually Owenitan or Smithian, this thus looses its sanctity for the basal Trias in Kashmir. The beds showing pre-Owenitan stages have now been traced in the section but are not so nicely exposed as in the Guryul ravine section.

The Pastannah section, also lost its importance by the discovery of the *Otoceras* from Dachigam Rakh Forest and near Pahlgam by BION (1914). The Otoceras bed (Zone of *Otoceras woodwardi*) (TOZER, 1972), an accepted basal bed of the Lower Triassic, lying below the 'Ophiceras' bed was again a subject of dispute as in Pahlgam *Otoceras* was found in association with the Permian *Productus*. BION, even then, considered it to be of Lower Triassic age.

Another section of the importance for the type of study is that of Spur, 3 kilometres north of Barus, referred by MIDDLEMISS (1909, 1910). This section, though, is not so well exposed as the Guryul ravine, but the Permo-Triassic transition beds are clear. The recent work of NAKAZAWA *et. al.* (1975) has considered it to be a good supporting section.

Besides Kashmir, in other parts of the globe, the existence of the Permian elements in the Lower Triassic beds have come to light; mainly from Salt Range, China, Wyoming U.S.A, Greenland Eastern Alps etc. Even from Himalaya, as back as 1899 BITTNER (pp. 9—10) reported a gastropod '*Bellerophon*' cf. *vaceki* BITTNER from Shalshal Cliff and Niti pass, which is a Palaeozoic straggler in the Otoceras bed. In Greenland, the Permian elements are considered to be reworked fossils, but in others with some certainity as survivors.

The presence of Mixed Permian-Triassic elements divide the palaeontologists, to believe or not to believe, in the traditional boundary below the *Otoceras woodwardi* Zone. Basicalıy this boundary is supposed to be at a line where most of the Permian families disappeared and new lines of evolution took place. The workers on bivalves and brachiopods believe this line to be above the disappearance of Permian families, while ammonoid workers at the base of the *Otoceras* Zone. In the continuously deposited Uppermost Permian and Lower Triassic, a transition zone with the Mixed Fauna, has thus become controversial among palaeontologists.

To resolve this, first attempt in Kashmir, specially in the Guryul ravine section was taken up by TEICHERT, KUMMEL and KAPOOR (1970). They properly defined the Permian and Triassic boundary and noticed that black shale of Zewan Formation (Upper Permian) of MIDDLEMISS (1909) with *Spinomarginifera* and other productid brachiopods of typical Permian aspect are in association with the *Claraia*, a bivalve of the lower half of the Scythian stage. They therefore interpreted the boundary at the base of this shale marked by a few centimetre thick bivalve coquina layers, thus suggesting that Palaeozoic — Mesozoic extinction was not an abrupt change but a gradual one, as evidenced by a 'Mixed Permian and Triassic Fauna'. Their views were supported by SWEET (1970) who recognized the boundary falling within *Anchignathodus typicalis* conodont zone, like Salt Range, Iran, Timor etc. Incidentally their boundary has only a slight difference with that of HAYDEN (1907).

The study of this problem was further enhanced by detailed examinations of the Guryul ravine and Spur 3 kilometres north of Barus by NAKAZAWA *et al.* (1970).

Their preliminary results put the boundary where TEICHERT et al. (1970) inferred it by taking the Scythian bivalve as basis. They also located the Otoceras bed with *Otoceras woodwardi* and the Permian ammonoid *Cyclolobus* (FURNISH *et al.* 1973), quite below the boundary. Views were expressed on the results of Kashmir by various workers, but only the important ones are included here. TOZER (1971, 1972) pointed out that the bivalve *Claraia*, below the *Otoceras woodwardi* Zone needs checking and even if proved, it might extend its limit to Upper Permian; MCTAVISH and DICKINS (1974) considered that 'survivors' may be reworked; NEWELL (1973) on the other hand considering all the aspects, suggested that the boundary between Permian and Triassic is marked where Permian families completely disappeared, *i. e.* at the top of the *Otoceras-Ophiceras* Zone. NAKAZAWA and RUNNEGAR (1973) explained this crisis that the Permian elements, specially bivalves, were not suddenly extinguished at the end of Permian, the disappearance was spread over a long period of Late Permian time and many groups of bivalves were apparently unaffected by the crisis which extinguished many invertebrate groups.

All these critical aspects were further reviewed by NAKAZAWA et al. (1975) to modify the boundary of Permian and Triassic in Kashmir. In their final report they consider the base of the *Otoceras-Glyptophiceras* Zone as the beginning of the Lower Triassic, even though a few Permian 'survivors' still continue. They, of course now, do not agree with the boundary of their preliminary report and bring it above by about 2.5 metres. The bivalve *Claraia 'stachei'* BITTNER referred to, has now been revised to *Claraia bioni* n. sp. It is viewed now that *Claraia* had its roots in the uppermost Permian. The survivors can not be accepted as reworked forms. The nature of their preservation in rock and their sudden adaptation to stunted growth, is possible only in changed environments.

The boundary, as now viewed, has been inferred by taking into consideration the world wide recession of the sea and extinction of the major groups that flourished in the late Palaeozoic. It is conformable and gradational and does not coincide with the lithological division (*i. e.* within Khunamuh Formation).

The Late Permian, Zewan Formation consists of sandy limestone, calcareous sandstone and sandy shale or shale. It is characterized by gastropods and bivalves similar to those of Chhidru Formation of Salt Range; *Cyclolobus walkeri* bearing bed is in association with *Anchignathodus typicalis* and *Neogondolella carinata* and suggests the very late Permian (early Dzhulfian, Araksian) age. The following member (basal unit—E_1) of the next formation consists of *Claraia bioni* sp. nov., *Etheripecten haydeni* sp. nov., brachiopods, *Anchignathodus typicalis*, *Neogondolella carinata*, *Ellisonia triassica* and is likely to represent uppermost Permian (Upper Dzhulfian, Dorashmian or Changsingian). The uppermost limit of this bed, thus marks the base of the *Otoceras-Glyptophiceras* Zone. Relatively shallow sea conditions during the Late Permian rather rapidly changed into the deeper, more off-shore environment at the beginning of the Triassic, in Kashmir.

The Lower Triassic of Guryul ravine: The Lower Triassic in Kashmir is well developed (about + 150 metres). The fauna known earlier from scattered localities indicated the possibility of different faunistic zones. However, the work of NAKAZAWA *et al.* (1975) at Guryul ravine and Spur 3 kilometres north of Barus has offered sections

where zonal succession can be defined stratigraphically and palaeontologically. They have established the lower division of the Lower Triassic but the upper part needs scanning to make them an ideal for the Lower Triassic Stratotype of the Tethys realm.

In Guryul ravine, the Lower Triassic strata are collectively named as Khunamuh Formation, of which the basal part belongs to the Permian. The formation is composed mostly of alternations of limestone and black shale, and is subdivided into six members E to J, on the basis of the amount of limestone. Member E, has been further subdivided into units E_1, E_2 and E_3. Unit E_1 is uppermost Permian. Member G refers to Cliff limestone, mentioned earlier.

The Lower Triassic beds of the Khunamuh Formation, in the lower division, are common in ammonoids, bivalves and conodonts, by which the formation can be divided into several zones (Text Figure 3) *i. e.*:

Ammonoid Zones:

Otoceras-Glyptophiceras; Ophiceras; Paranorites—Vishnuites; Prionites—Koninckites; and *Owenites—Kashmirites.*

Bivalve Zones:

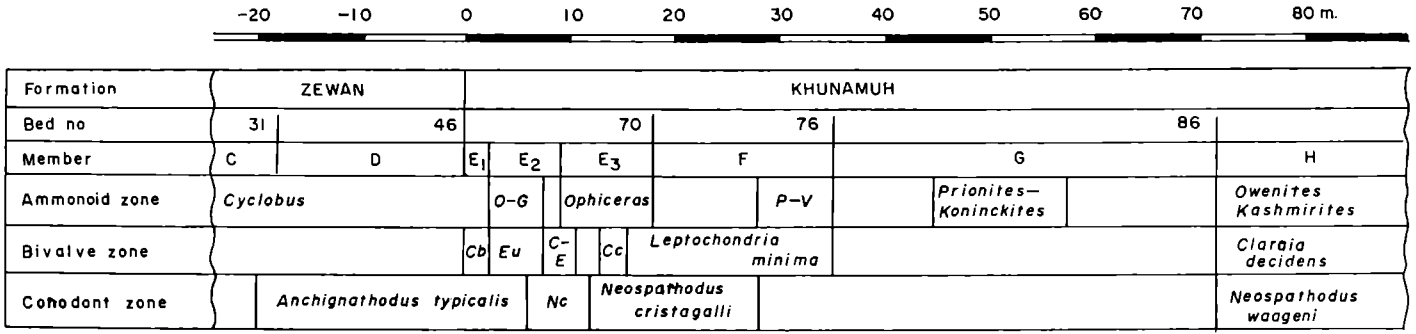
Eumorphotis venetiana—Eumorphotis aff. *bokharica; Claraia* cf. *griesbachi—Eumorphotis multiformis; Claraia concentrica; Leptochondria minima;* and *Claraia decidens.*

Conodont Zones:

Anchignathodus typicalis; Neogondolella carinata; Neospathodus cristagalli and *Neospathodus waageni.*

The reported *Anahedenstroemia* (HAYDEN, 1907) comes somewhere from Member G, probably from the basal part of the Cliff limestone. Member H, represents Meekoceras bed of the earlier workers and now shows a true Smithian (Owenitan) age. *Meekoceras gracilitatis* in this bed justifies the position of this bed with the American equivalent rather than the Himalayan, the latter being older.

The so called '*Ophiceras*' fauna of Pastannah: The Pastannah section of Kashmir, is famous for its '*Ophiceras*' fauna. It is also well known for the youngest Lower Triassic *Prohungarites* bed (based on the fossils from loose material, DIENER 1913). The critical '*Ophiceras*' fauna of the section was supposed by some to represent a true or synchronous *Ophiceras* fauna of Himalaya (DIENER 1913, SAHNI 1939, VERMA and SASTRY 1963, KUMMEL 1970a) and by others a Smithian or Owenitan fauna (BION 1914, TOZER 1969, 1971, MCTAVISH and DICKINS 1974). KAPOOR (in MCTAVISH and DICKINS 1974) in a recent re-examination, compared Pastannah section with the Guryul ravine section and located sediments with the fauna of lower division of the Lower Triassic comparable with the zones from *Otoceras—Glyptophiceras* to *Prionites—Vishnuites*, quite below the so called 'Ophiceras' bed. The *Otoceras* was not encountered but it is likely to be present in the sediments concealed under dense growth. The so called 'Ophiceras' bed includes *Owenites, Meekoceras, Pseudosageceras, Glyptophiceras* (older form, might have continued), *Leptochondria minima, Claraia decidens, Neogondolella carinata, Neospathodus conservitus, Neospathodus*



O-G; *Otoceras-Glyptophiceras*, *P-V*; *Paranorites-Vishnuites*, *Cb*; *Claraia bioni* *Eu*; *Eumorphotis Venetiana—E. aff. bokharica* *C-E*; *Claraia* cf. *griesbachi-Eumorphotis-multiformis*, *Cc*; *Claraia concentrica*, *Nc*: *Neogondolella carinata*,

Figure 3

Ammonoid, Bivalve and Condont Zones in the section of the Guryul Ravine, Kashmir (After NAKAZAWA *et al.*, 1975).

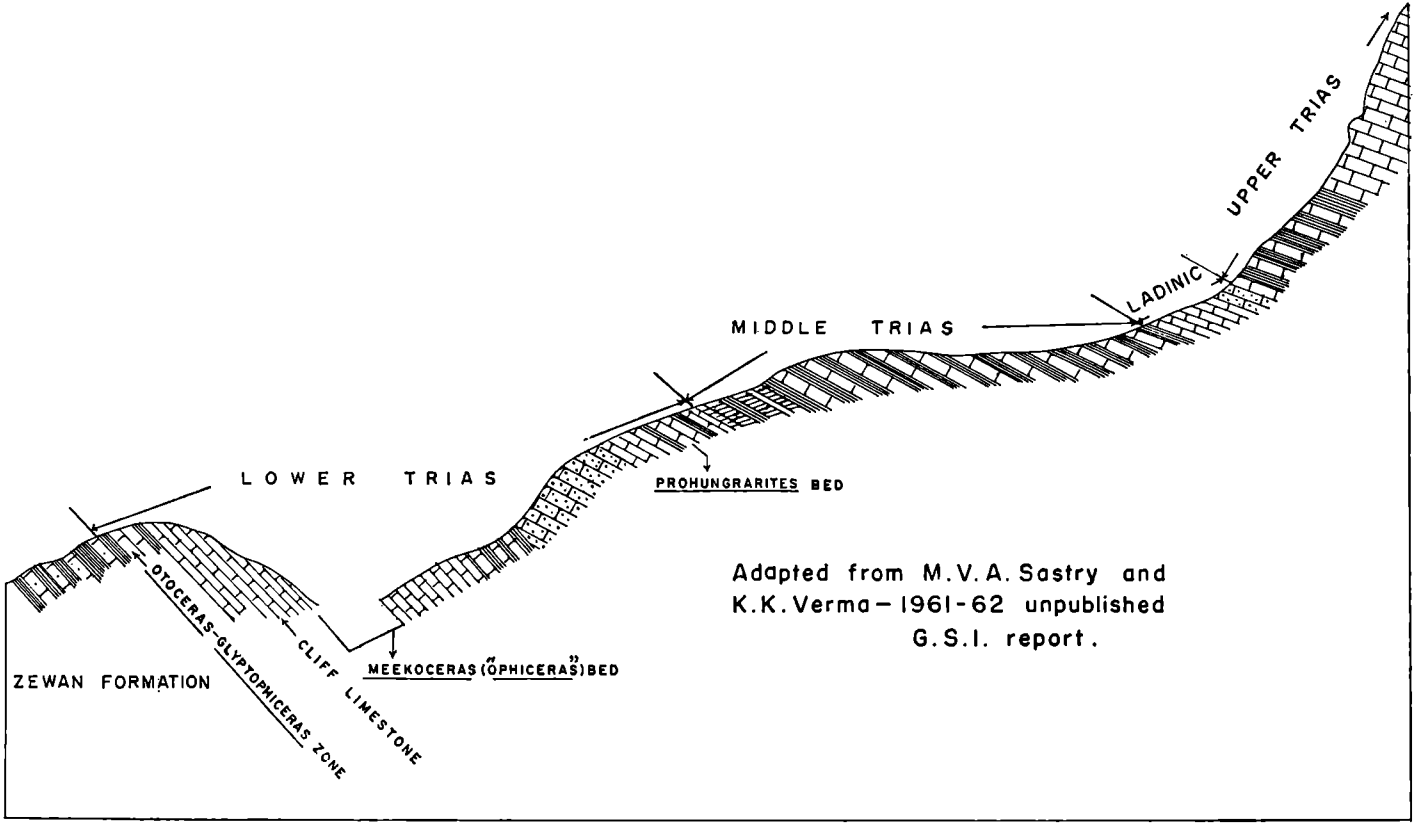


Figure 4

Pastannah section of Kashmir.

waageni and *Ellisonia triassica**). The assemblage represents a *Meekoceras—Anasibirites* interval, *i. e.* Owenitan or Smithian age. Stratigraphically as well as faunistically it is equivalent to the Meekoceras bed of the Guryul ravine section therefore, it will be appropriate now to call this bed as Meekoceras bed (Text Figure 4).

The Prohungaritan or Spathian bed was presumed by DIENER (1913) in Pastannah section by the study of fossils collected by MIDDLEMISS (1910) from debris. This bed later on was found by SASTRY and VERMA in actual stratigraphical position (GSI unpublished report). The Smithian *Anasibirites* bearing bed is also known from Kashmir from a single locality *viz.* Mandakpal. Two species, *Anasibirites kashmiricus* and *Anasibirites* aff. *ibex* are described by DIENER (1913).

Pir Panjal: The western flanks of the Pir Panjal are not so important for Triassic stratigraphy as for palaeogeography. WADIA (1928) showed the presence of Permian beds directly overlain by Upper Triassic limestone and thought, the absence of Lower and Middle Triassic due to non-deposition, being a bit away from the receding Tethys. KAPOOR and BANDO (1974) however, have shown that at least Griesbachian stage is developed in this part of the Pir Panjal.

Bhallesh, Chamba and Tandi regions

A few important finds of Triassic beds in the supposed early Palaeozoic sedimentary and metasedimentary rocks have suggested the extension of the Tethyan Triassic further south. This extension, whether due to structure or a possible common sedimentary basin, is still an open question needing further researches. Faunistically and lithologically, they appear undoubtedly as parts of Kashmir and Spiti basins.

In Bhallesh region RAINA, ALOK and SUNDARAM (1971) followed by KAPOOR (1973), established thick strata, locally named as Bishot Formation of Griesbachian stage; its stratigraphy as well as fauna is undisputedly comparable with the lower members of the Khunamuh Formation of Kashmir.

BHATTACHARYA *et al.* (1971) and DATTA and SINGH (1973) have extended the limits of the Bishot type of sediments with little support of fauna in Kalhel area of Chamba.

The Tandi region, further north-east of the Bhallesh, is more fascinating, because within a small area a limestone formation exhibits a sequence from Permian to Jurassic (POWELL and CUNNINGHAM, 1973; GUPTA, 1974; RAINA *et al.*, 1975).

Zanskar region

The Triassic sediments lying in Ladakh, Zanskar range, Rupshu, Lahul, Pangi and Chharap (Tsarap of old literature) are included here in the Zanskar region. The presence of Lower, Middle and Upper Triassic is known from various parts of the region, but no significant standard section has yet been established. The faunal information is also little and distributed to a number of localities. Triassic is usually

*) The faunistic information is by Dr. B. KUMMEL and Prof. K. NAKAZAWA, who are collaborating with this work.

highly folded and disturbed. The recent surveys in various parts of the region have found extension of Triassic strata in unexplored areas; the survey parties have also made an attempt to divide rocks of this system lithostratigraphically because they could not gather much of the faunal evidences. All the workers, however, believe unanimously that this region is an extension of the Spiti basin.

Recent studies by RAINA and BHATTACHARYA (1975) and RAINA *et al.* (1975) in the Chharap valley have intended to evolve a Triassic section of the region, especially for Upper Triassic. A highly folded and shattered 400 metres thick section, of this area includes Lower and Middle Triassic including Ladinian. It is difficult to subdivide. The younger rocks of Carnian and Norian, on the other hand give a clear picture of Spiti equivalents. These authors believe in an angular unconformity between the youngest Quartzite bed of the Norian and the overlying Megalodon Limestone, with *Dicerocardium himalayense* and *Megalodon ladakhensis*. The lower part of the limestone, designated as Kioto stage, in their opinion is Jurassic rather than Rhaetian.

This suggestion, at present, is premature because the age assigned to the lower part of the Megalodon Limestone (Parastage) was based on the type section of Spiti; where an unconformity has to be proved. The Rhaetian age inferred to this bed by pioneers, was in the position between Norian and Jurassic fossil bearing beds, with the support of the true Triassic brachiopods. *Megalodon* and *Dicerocardium* independently range from Norian to Lias and are not of diagnostic value for Rhaetian or Liassic age. The reported *Hoplites* by RAINA *et al.* (1975) also occupies a higher position in the limestone.

Spiti region

The classic section of the Triassic of Lilang, with supporting sections of Muth, Kaga and the Thanam river lying in the Spiti region of Himachal Pradesh have been basis for most of the faunal zones, substages and stages in Himalaya and adjoining countries. The spiti region with the Central Himalayan region, include a mixed Alpine Mediterranean and Indopacific fauna.

The Lilang System of Spiti named by HAYDEN (1912) embraces Lower, Middle and Upper Triassic. It is divisible into a number of well defined stratigraphical beds (and faunistic zones). HAYDEN (1912) adapted Alpine subdivisions in grouping Triassic beds, on the other hand WADIA (1961) preferred Germanic subdivisions. The Germanic subdivision to the Himalayan marine Triassic is not proper because of the different set up. HAYDEN in his classification was not clear about the position of *Otoceras* and *Ophiceras* Zones and also to the boundary between Rhaetian and Lias. This was later resolved by DIENER (1912) by bringing these beds to the proper standard scheme. This region, specially the Lilang section are of utmost importance and needs modern re-analysis because of a number of lacunae in the stratigraphy. A few of which are indicated below:

1. We are unaware of the presence of any mixed zone between Kuling Shale (= Productus Limestone) and Otoceras bed. The boundary zone therefore needs to be thoroughly re-examined.

2. The so called Meekoceras bed (or Zone) of Spiti is considered to be intimately connected lithologically with the Ophiceras bed (or Zone); the faunistic subdivisions therefore, need to be sharply defined into stratigraphical horizons of parameter importance, as pointed out by DIENER (1912). If these beds are compared with the Kashmir section, there appears to be an example of condensation of beds.

SPATH (1934) puts Meekoceras bed of Himalaya (Spiti and Central Himalaya) under *'Celtites' radiosus* Zone of Gyronitan age. The fauna includes species of *Prionolobus, Proptychites* and *Koninckites* comparable with the *Prionites—Koninckites* Zone of Kashmir. On the other hand it creates confusion with the *Meekoceras* Zone (or bed) of America, which is younger in age. NEAVERSON (1962) has already suggested revision of this bed to Proptychites bed, but considering the uniformity of beds with an alike fauna, it is suggested that this should be called a Koninckites bed.

3. The Hedenstroemia bed in Spiti is supposed to indicate youngest ammonoid bearing Lower Triassic. It represents Flemingitan age. KUMMEL and STEELE (1962) have pointed out similarity of *Hedenstroemia* fauna with the Owenitan Meekoceras bed of America. Except five of the genera of Spiti, all are known from America. This bed is also comparable with the *Owenites—Kashmirites* Zone (Meekoceras bed) including *'Hedenstroemia'* layer of Cliff Limestone of Kashmir. The assemblage therefore is likely to cover two faunal zones. However, for the time being it is appropriate to revise tentatively this bed to Meekoceras bed from Hedenstroemia bed to bring uniformity in the nomenclature of faunal beds.

4. The faunas, referable to Columbitan and Prohungaritan ages of SPATH (1934) are not yet known from Spiti, thus giving cause to a controversy about the boundary between the Lower Triassic and the Lower Anisian. In Himalaya (including Spiti) this boundary is ill defined; it is taken at the base of the Zone bearing *Rhynchonella griesbachi, Retzia himaica* and ammonoid *'Sibirites' prahlada*. This zone is overlain by an apparently unfossiliferous 15 metres or more thick Niti Limestone (= Nodular Limestone) and is further succeeded by a bed with *Durgaites dieneri (Keyserlingites dieneri)* and other Anisian ammonoids (DIENER, 1912).

HAYDEN (1912) and WADIA (1961) consider the boundary of Lower and Middle Triassic within the Niti Limestone; while PASCOE (1959, p. 862) in his manual suggests brachiopod bed to be Columbitian and Niti Limestone to be Prohungaritian; thus putting the boundary below the ammonoid bed, TOZER (1965) feels that the horizon of *Keyserlingites dieneri* in the Himalaya may be Upper Scythian. DIENER (1912) who considered this bed to be of Anisian age, already indicated the external resemblance of *Keyserlingites dieneri* with *Keyserlingites subrobustus* of Siberia. He pointed out the characteristic differences with larval and adoloscent stages and proposed the new generic name *Durgaites* for Himalayan species. KUMMEL (1968) mentions the first occurrence of a late Scythian *Keyserlingites* from Afghanistan in the Tethyan region. Its Anisian species, according to him are that of Himalaya and Timor, the Scythian species in his opinion are mainly from Arctic region and Western North America. The same author (KUMMEL, 1969) also points out that the age assignment of Himalayan Anisian has a number of ambiguities which warrant a thorough reanalysis.

The Cliff Limestone of Kashmir and Niti Limestone of Spiti (and also of Painkhanda) stratigraphically are quite close; both the areas show *Anahedenstroemia* in the underlying layers. The only difference is that in Kashmir *Meekoceras* fauna (Owenitan) is in the youngest layers of Cliff Limestone, while in the later it is supposed to be within the Anahedenstroemia bed, which is below the unfossiliferous limestone. This point is of value for the wider geological changes (facies difference) and also for re-analysis of beds.

It will therefore be desirable, that if no megafossil support to resolve the boundary between Lower and Middle Triassic comes out, attempts on microfossils like conodonts should be made in the Himalaya. In Spiti (and also in other parts of Himalaya) bed equivalent to *Paraceratites trinodosus* Zone are undoubtedly clear and well defined and older zones are only in query at present. The fauna of Beyrichitan (= Lower Anisian of TOZER 1974) has been mentioned in literature, still it is not properly defined stratigraphically; we yet do not know an equivalent of *binodosus* Zone (lower part of Paraceratitan age of SPATH = Middle Anisian of TOZER, 1974).

Ladinian in Spiti is well developed and is about 90 metres thick comprising of Daonella shale and Daonella Limestone. It starts so gradually from Upper Anisian strata that it is rather difficult to mark any definite line between them. They are supposed to represent both *Protrachyceras reitzi* and *Protrachyceras archelaus* Zones, of Ceratitan age (Lower and Upper Ladinian of TOZER, 1974). The Ladinian of Spiti with all the known details still needs re-assessment in the light of latest contributions in the Alps and Canada. The upper part of the Daonella Limestone (19 metres), according to DIENER (1912) is Carnian in age.

About 500 metres thick sediments belonging to upper part of Daonella Limestone, Halobia bed, Grey bed and Tropites bed collectively indicate Carnian strata. The Halobia bed along with the underlying Daonella Limestone are compared with the *Trachyceras aon* Zone of Alps, though this ammonoid is not encountered. The other two beds show Carnitan and Tropitan ages, which are inferred by SPATH from Spiti section. Recent analysis by TOZER (1974) and others have suggested two divisions of the Carnian instead of the prevailing three. From Himalayan sections, it will be rather difficult, at present, to suggest any thing because zoning is improper and the fossils from different stratigraphical beds have only been given a status of horizons.

5. The Norian in Spiti is about 270 metres thick represented by Juvavites bed, Coral Limestone, Monotis shale and Quartzite bed. They are supposed to represent all the three stages of Norian, but on ammonoid analysis only Haloritan age of SPATH (1934), thus leaving a gap of Pinacoceratitan. The Norian beds are more signified by bivalves than ammonoids. It is therefore felt that after a thorough re-examination of the sections of the Spiti and also of Painkhanda, if no further support from ammonoids comes forward, then the subdivisions based on bivalves should be adopted. The bivalves undoubtedly point out the presence of late Norian elements. The bivalve study will also resolve the Rhaetian and Norian boundary, *i. e.* whether Choristoceratan ammonoid age is present or absent. There is undoubtedly a fluctuating basin from Middle to Upper Norian as evidenced by the presence of plant bed below the Coral Limestone, followed by areno-calcareous sediments and finally by arenaceous rocks.

The youngest stage of Triassic (Rhaetian) is supposed to be within Megalodon (= Kioto) Limestone and represents a parastage. Faunistically Himalayan sections of this stage suggest its merger either with Norian or with Lias. The bivalve fauna is long ranging *i. e.* from Norian to Lias, while brachiopods support Upper Triassic affinity. Lithologically Lias and supposed Rhaetian are not easily to differentiate. If agreement is to be made on the basis of Spiti or Painkhanda sections, it will be appropriate to consider Rhaetian strata of Himalaya, as only a part of Norian as suggested by TOZER (1974) *i. e.* by suppressing the Rhaetian as a chronostratigraphic division, and extending the Norian to the top of the Triassic.

Central Himalayan region and Tinkar Lipu area of Nepal region

The areas of Painkhanda, Byans, Dharma valley, Lissar valley, Kiunglung, Tinkar Lipu area of Nepal region and 'Exotic Blocks' of Malla Johar are covered under the Central Himalayan region.

The Niti pass in Painkhanda, is one of the localities from where in 1851, Capt. R. STRACHEY discovered the presence of marine Triassic from the Indian subcontinent. The details worked out by GRIESBACH (1891); DIENER, GRIESBACH and MIDDLEMISS in a joint expedition in 1892 in Painkhanda area and by VON KRAFFT (1902) in Byans and the 'Exotic Blocks' of Malla Johar with the palaeontological studies by BITTNER, MOJSISOVICS and DIENER, published in an umber of scientific journals in India and abroad, laid the basic concept of the Himalayan Triassic and showed the importance for world-wide correlation.

The Triassic of the Spiti region is almost the continuity of the Painkhanda, but is more clear. The Byans area, on the other hand, is peculiar in its stratigraphy of the Triassic. HEIM and GANSSER (1939) have given a fairly good description of a number of the localities of this area; their collection was studied by JEANNET (1958, 1959). They have established the continuity of Byans in the Tinkar Lipu area of Nepal.

Painkhanda area: The Bambanag and Shalshal Cliff sections of Painkhanda show more or less uniformity in most of the beds recognized. The Lower Triassic in Painkhanda is thicker than in Spiti (12 metres). The Anisian stratigraphy is also the same as in Spiti. The Ladinian is condensed to 6 metres (in Spiti it is 90 metres) and it is difficult from the available data to demarcate, at present its two substages. The Daonella limestone rather presents a passage to basal bed of Carnian (Traumatocrinus Limestone, 6 metres). The basal Carnian is compared with the *Aonoides* Zone of Trachyceratan ammonoid age. The Carnitan and Tropitan, here are present in a single 244 metres Halobia bed, unlike Spiti, where there are clearly three stratigraphical units. TOZER (1974) has suggested that Carnian should be subdivided only in Lower and Upper. The Lower Carnian considered to represent the Cordevolic substage, will be prefered to include also the Julic, because there is insufficient evidence to separate the two substages (*Aon* and *Aonoides* Zones of Trachyceratan age of SPATH). Halobia bed, according to this modification is Upper Carnian.

The Norian, about 300 metres thick, is represented by a Nodular Limestone, Halorites bed, Earthy Limestone (Lower Norian), Sagenites (or Anodontophora)

bed (Middle Norian) and Quartzite Series (Upper Norian). The Lower Norian of Spiti (Juvavites bed) in Painkhanda covers three distinguishable stratigraphical horizons. The horizon of *Proclydonautilus griesbachi* in the basal bed is also not known in Spiti. The Sagenites bed represents Coral Limestone and Monotis bed of Spiti with a reduction of thickness of Middle Norian from 122 metres (in Spiti) to 76 metres. Upper Norian Quartzite 'Series' in Painkhanda also shows thinning. Megalodon Limestone, supposed to be Rhaetian in lower horizons, do not show any difference.

Byans area including Tinkar Lipu of Nepal: The area of Byans and adjoining part of Nepal, lately worked out by HEIM and GANSSER (1939) and by a number of Indian geologists, include famous sections of Kuti, Kalapani, Lilinthi, Jolinka etc. of Uttar Pradesh and Tinkar Lipu of Nepal. An improved stratigraphy was introduced for this part of Himalaya by HEIM and GANSSER. A number of workers, recently adapted this scheme in the Niti area (Painkhanda), but according to the present author this is neither feasible nor acceptable, due to the peculiarities of this area.

The Triassic in this area is divisible into Chocolate Limestone (Series) (45 metres, Lower Triassic), Kalapani Limestone (Grey Limestone of previous workers) (80 metres, Anisian and Ladinian), Kuti Shale (300 metres, Carnian and Norian) and Megalodon Limestone (? Rhaetian).

The *Ophiceras* Zone is suspected to be at Kuti and Jolinka. The Koninckites bed (former 'Meekoceras' bed) is also known from these localities. Owenitan or Smithian Meekoceras bed (Hedenstroemia bed) is clearly represented in the sections of Byans, Kalapani and Tinkar Lipu. The younger subzone of Owenitan (*Anasibirites spiniger* Subzone) is characteristic in this area. GUPTA (1972) and SAHNI and CHHABRA (1975) reported a conodont fauna from Kalapani Limestone, but it indicates an assemblage which can be referred to Koninckites bed and Upper Anisian.

In this part of the Himalaya the Anisian — Lower Triassic boundary has also been concluded by DIENER (1912) on a brachiopod bed. *Durgaites* horizon is still unknown in Byans. Paraceratitan *Trinodosus* Zone is the only true and recognizible horizon in Middle Triassic of the area. Ladinian suspected to be in Kuti Shale, by HEIM and GANSSER (1939), was confirmed by JEANNET (1959). SASTRY (1962) has however, indicated an Upper Ladinian age in Tinkar Lipu on his study of ammonoids and brachiopods.

The Upper Triassic in Byans is highly crushed and disturbed with a very few known fossil zones. The most important of all is a one metre thick Tropites bed, with a strange assemblage of Carnian and Norian types. Among the rich ammonoid species, 53 suggest a Carnian age and 49 Norian. This condensation has two possibilities *viz.* a transition or an admixture due to non-deposition of sediments.

In Tinkar Lipu the presence of Norian is recognized in Halorites-Juvavites bed by JEANNET (1959). *Monotis salinaria* of late Norian is also known from beds above Tropites bed.

KUMAR, MEHDI and PRAKASH (1972) believe in the presence of a passage bed between Norian and Rhaetian (Megalodon Limestone); while SHAH and SINHA (1975) dispute this and consider the same as a gradual merger.

'Exotic Blocks': The Exotic Blocks *i. e.* rootless klippen floating in a sea of serpentinite (HEIM and GANSSER, 1939), popularly known as the 'Exotic Blocks'

of Malla Johar of Tibetan facies, are isolated blocks scattered over volcanics in the areas of Chitichun, Keogarh, in the north and north-eastern parts of Uttar Pradesh. They are more important for their fauna than the stratigraphy. Blocks with *Koninckites* fauna, *Durgaites* fauna and Upper Carnian fauna are well known. The Carnian fauna is allied to the Mediterranean zoo-geographic province.

Nepal region

The Tinkar Lipu area of this region has already been dealt with in the above paragraph. The other area of importance is the Thakkola (or Dolpo or Muktinath), in Central Nepal.

Fuchs (1964), Bordet (1971) and geologists of the Geological Survey of India have brought out a clear picture of the Triassic stratigraphy of this area, by showing the presence of a continuous sequence of Lower, Middle and Upper Triassic.

Kapoor and Bando (1973) suspect the presence of a Permian-Triassic transition bed in this area. Kummel (1970) recognized Koninckites bed and Owenitan *Anasibirites* subzone. The Middle Triassic is likely to represent the Upper Anisian of Spiti, as is evidenced by known ammonoid fossils. The study of conodonts by Fuchs and Mostler (1969) suggests a continuity of sediments from Dienerian to Lower Anisian as marked by *Gondolella nevadensis*, *Neogondolella milleri* and *Neospathodus timorensis* Zones.

The Fauna from this area is still little known, but it is an important area for the eastern sector of the Himalaya, due to its immense thickness, well developed and uninterrupted stratigraphy.

Sikkim region

The Triassic of Sikkim, known as Chho Lhamo (= Tso Lhamo) Series is known by the work of Auden (1935). The faunal studies by Sahni (Pascoe, 1959, p. 887), Sastry and Mathur (1962) and Raina and Bhattacharya (1975) suggest only an Anisian fauna of the Paraceratitan age.

Bhutan region

The Triassic of Bhutan, designated as Lingshi Series by Nautiyal *et al.* (1964), is in the preliminary stages of investigation. It is reported to be about 2000 metres thick. They have also reported fossils *viz. Orthoceras*, *Daonella*, *Lima*, *Pseudomonotis*. This series is comparable with the Dothak series of the Chumbi valley in Tibet.

Conclusions

1. The review of the Triassic beds of the Himalaya has shown that there is uniformity of beds in most of the sections; the variation in thicknesses in various beds can of course be attributed to abrupt facies changes and condensation.

At present we have an immense amount of data on Triassic from the different parts of the globe; specially from North America, Greenland, Arctic Canada, Alps,

Afghanistan, Iran, U.S.S.R., Pakistan (Salt Range), Kashmir, China, Timor, Australia, Japan etc. The workers on Triassic find a number of ambiguities, while correlating the different zones from the classical sections of Himalaya.

The bivalves and brachiopods, which were not given much of the importance in the Triassic stratigraphy, appear to be important now to resolve many of the controversies in the absence of ammonoids in beds. The conodonts have already established their significance in the zoning of Lower and Middle Triassic. In the Himalaya, the conodont studies in Kashmir and in Nepal have yielded very fruitful results; still much is left to get a clear picture of conodont studies from different beds of the complete Triassic of the Himalaya. Partly the reason is the situation of Triassic beds in highly rugged parts of higher ranges, where approach is difficult and working time is limited. These areas, however, need immediate attention for reassessment, and require re-investigations on the lines of the latest developments, due to their world-wide correlative importance.

2. From the above it will be seen that no single scheme will serve the purpose to classify the Himalayan Triassic. It is therefore felt necessary that a new uniform stratigraphical scheme, useful for geologists and palaeontologists, should be introduced for the entire Himalayan Triassic, which can help in distinguishing the different fossil beds. The following scheme prepared after considering all the aspects and available data, is tentatively proposed. This is a modification of the already existing different schemes for the Himalaya. It will no doubt be subject to further modifications from time to time, when more data are available.

? Rhaetian	Megalodon bed	
Norian	Spirigera bed (Quartzite Formation)	
	Monotis bed (Sagenites bed)	
	Coral bed	
	Juvavites—Halorites bed	
Carnian	Nodular Limestone	
	Tropites bed	
	Grey bed	
	Halobia—Traumatocrinus bed	
Ladinian	Upper Daonella bed	
	Lower Daonella bed	
Anisian	Trinodosus bed	
	Durgaites bed	Position uncertain
	Niti Limestone	Lower or Middle Triassic
	Brachiopod bed	
Lower Triassic	Prohungarites bed	
	Meekoceras bed	
	Koninckites bed	
	Vishnuites bed	
	Ophiceras bed	
	Otoceras bed	

3. Triassic Schemes of Classification: Today, hardly a subdivision of the Triassic System is free of controversies, as to its scope and nomenclature. There is also no general agreement regarding the lower as well as upper limit *e. g.* a group of workers believe that the beginning of Triassic can be taken above the *Otoceras—Ophiceras* Zone, while others believe in retaining the beginning below this zone; even for Rhaetian, some French geologists hold the view that the Jurassic System begins with the Rhaetian stage, which is regarded almost universally as the uppermost division of the Triassic System. The views have also been expressed to suppress this appreciably smaller division of chronostratigraphy and to extend the Norian to the top of the Triassic (TOZER, 1974). We have, thus, to evolve a method to resolve the diverse views and confusions related to the Triassic by mutual exchange of knowledge and cooperation; the results of which may be well defined, uniform and of world-wide utility.

A number of Triassic schemes, which include MOJSISOVICS, WAAGEN and DIENER (1895), NOETLING (1905), DIENER (1912), SPATH (1934), KUMMEL (1957) and others on Himalayan Triassic, based on ammonoid zoning, have been revised from time to time. The pioneer schemes suggested comparison of Indian beds with the European equivalents, but later ones (mainly SPATH; and KUMMEL's zonal scheme—which are still followed) were introduced by compilation of the data from different horizons/zones of the world. Besides the complete Triassic, there are many more alternative schemes confining only to the Lower Triassic. These have a number of points of significance but it will be beyond the scope of the present paper to discuss their merits. However, special mention is to be made of the lately proposed scheme by KIPARISOVA and POPOV (1964) for the Lower Triassic of the Asiatic region, with two different type areas (Himalaya and Olenek). But this has almost the same restrictions as that of SPATH, because of two distantly situated areas. It is interesting to note that inspite of the differences in nomenclature there seems to be unanimity regarding the correlation of the Lower Triassic strata.

The shortcomings of the Triassic schemes in general fall in three categories according to TOZER (1974) *viz.* (1) 'some zones were arranged in the wrong order, owing to insufficient stratigraphic data' *e. g.* "Meekoceras" bed of Himalaya (now considered to be Koninckites bed) are different from true Meekoceras bed of Kashmir (Smithian or Owenitan); the so called Ophiceras bed of Pastannah (Kashmir) is actually Meekoceras bed of Smithian stage; (2) 'the faunas believed to represent some zones are based on collections from condensed or mixed deposits of more than one age' *e. g.* "Hedenstroemia" bed of the Himalaya, besides its similarity with the Owenitan fauna also suggests partial similarity with the Flemingitan, it may include two different horizons; Tropites bed of Byans are already known to include Norian and Carnian faunas; (3) 'significant time intervals have been found to exist for which there was no accomodation in the standard schemes' *e. g.* Niti Limestone of Himalaya.

TOZER (1974) also points out that 'The ideal standard Stratigraphic Scale would be one in which all divisions, down to the smallest (subzone) would be of world-wide application. It seems unlikely that this ideal will ever be attained, because it is usually possible on any one continent, or in a more restricted area,

to devise a scheme, with subzones and zones as the smallest divisions, which proves too refined for world-wide application. A single universal scale, using everywhere the same smallest divisions, seems an unattainable ideal. Europe and Asia, like North America, may eventually have 50 or more significant divisions within the Triassic but it seems unrealistic to suppose, or anticipate, that all will correlate exactly with one another, even within one continent. At some levels the zones may be of world-wide application.' ... 'But more commonly the zones, although not recognizable everywhere else, tend themselves to form groups with adjacent zones, and the resultant groups (substages) do prove widely recognizable ...' 'If an acceptable scheme of nomenclature for divisions of this scale can be devised it will prove a valuable medium for expressing intercontinental correlations.'

TOZER (1967) considering most of the above points and also with the view that the name of stages and substages should be derived from the section, of which the zonal successions can be defined stratigraphically as well as palaeontologically, proposed the scheme from the type of the Arctic Canada. His refined scheme seems to be more logical and of greater utility. The differences in the faunal contents of his type with that of Tethyan Triassic need only adjustments by grouping for different zoogeographic provinces, as already suggested by him.

4. The base of the Triassic: This has already been dealt with in detail in the description of the Kashmir region, and earlier in the conclusion. The period of turn-over from Permian to Triassic is so critical that it is difficult to satisfy palaeontologists working in different groups. There is no doubt about the presence of Permian survivors (brachiopods, bivalves etc.) in the Lower Triassic where sections of Permo-Triassic are uninterrupted. Considering the era of Trias, mainly of ammonoids, importance should, therefore be given to the base deduced on the ammonoids. It will be difficult to come to unanimity, if other aspects like lithological, environmental etc. are taken in view. As most of the workers have accepted the base of the Triassic just below, the *Otoceras woodwardi* Zone, we should stick to it, otherwise we may have to change the base of the Triassic from time to time.

5. The subdivisions of the Lower Triassic: The equivalents of the four stages of TOZER (1967) are known in the Lower Triassic of Kashmir; these have been almost established up to the early Smithian from basal Griesbachian. It is felt that a little more work on Smithian and Spathian can evolve zoning for the entire Lower Triassic of the Tethyan realm. In Kashmir Dienerian and Smithian fauna are distinct, as well as stratigraphically well defined.

In other sections of Himalaya, feasibility to apply this scheme is to be seen. At present, the stratigraphic position, as well as the fauna of a number of beds need further confirmation, in the light of points discussed in the text. This is important, because of the historical importance of the sections.

6. Middle Triassic: Almost in the entire Himalayan belt, *trinodosus* Zone of Upper Anisian is clear. The Lower and Middle Anisian (of TOZER's Scheme) can only be suspected at present, as indicated by certain fossils. The boundary between Lower and Middle Triassic is also not clear.

The Ladinian stage is clear in the Himalaya, specially in Spiti, where there are two distinct stratigraphical divisions. *Protrachyceras archelaus* Zone is also clear. This well developed stage, which is fairly thick and also rich in bivalve fauna still warrants a very close study for further subdivisions and for its lower and upper limit.

7. Upper Triassic: The sections of Spiti and Central Himalayan regions offer well developed sections for the Upper Triassic. In Kashmir, they are undoubtedly thick but poor in fossils.

The pioneer workers could not contribute much to distinct the boundary between Ladinian and Carnian, Carnian and Norian, and Norian and Rhaetian. The broader correlation of the Himalayan fauna with Alpine fauna, undoubtedly suggests the presence of almost all the corresponding ammonoid zones of Carnian and of Lower Norian. The younger upper part of the Triassic has only the bivalve and brachiopod support.

It will not be out of the way to refer here to the controversy of boundary between the Norian and Rhaetian. The *Halorites procyon* Zone of the Himalaya has been compared with the *Cladiscites ruber* Zone of the Alps (? Middle Norian). The Zones of *Trachypleuraspidites* aff. *griffithi* and *Sagenites* sp. may also represent the Middle Norian?, but in a higher position. The bivalves, more particularly *Monotis salinaria* of Himalaya has been compared by WESTERMANN (1964) to represent a middle substage of Norian (*bicrenatus* Zone) (TOZER'S scheme). This indirectly favours that the thick 'Quartzite Series' with *Spirigera maniensis* (76 metres) represents *metternichi* and younger zones of late Norian.

The Rhaetian in the Himalaya is only inferred by its position between true Lias and supposed Upper Norian, with the support of Upper Triassic brachiopod fossils and lithological change. The contact between the two has also been referred to as unconformable, transitional/gradational in different sections.

The rarity or the absence of ammonoids in the Upper Triassic, besides Himalaya is also known from other sections. It will therefore be desirable to utilize the bivalve and brachiopod fauna for the subdivisions of the upper part of the Triassic. ZAPFE (1967) has already justified that in terms of ammonoids it is difficult to recognize a Rhaetian stage. TOZER (1974), on the other hand to resolve this, believes in the suppression of the stage as a chronostratigraphic division and to extend Norian to the top of the Triassic.

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