TABLE II

Preference for darkness

Period	A series				B series			
	No. of worms		% Preference		No. of worms		% Preference	
	Darkness	Red	Darkness	Red	Darkness	Yellow	Darkness	Yellow
Initial	40→	..	..	..	..	←30	..	..
After 1 day	38	2	95	5	3	27	10	90
After 2 days	38	2	95	5	6	24	20	80
After 3 days	36 (1 died)	2 (1 died)	94·7	5·3	8 (3 died)	16 (3 died)	33·4	66·6
After 4 days	34	4	89·5	10·5	9	15	37·5	62·5
After 5 days	28 (1 died)	7	80	20	11	13	45·8	54·2
II Set								
Initial	..	←35	..	..	24→	..	..	..
After 1 day	3	32	8·5	91·5	20	4	83·3	16·7
After 2 days	4	30 (1 died)	11·2	88·8	20	4	83·3	16·7
After 3 days	8	25 (1 died)	24·2	75·7	20	4	83·3	16·7
After 4 days	9	23	28·2	71·8	..	..	..	...
After 5 days	11	20	35·5	64·5	..	..	..	..

many as 5 days, those migrated during the first three days being only of the order of two (5%).

Migration from red towards darkness was progressively on the increase, nearly one-third of the population having traversed from red to darkness within five days. Moreover, from the data given in Table II as well as other experimental results (not presented here) it became evident that after some days of exposure to red light the worms began to die out under its influence. This was somewhat unexpected though. To sum up, it may be mentioned that to study the worms during the nights yellow/green/blue light should be preferred to red as suggested earlier.

The authors record their thanks to Professor J. V. Bhat for his guidance and to Indian Council of Agricultural Research, New Delhi, for the Fellowship, to Dr. A. Krishna Rao, the Dean and to Shri T. Ramesh Pai for facilities provided and to Miss K. Lalitha Bai for technical assistance.

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EARLY LOWER TRIASSIC CONODONTS FROM SPITI RIVER SECTION*

SINCE the pioneering stratigraphical and palaeontological works of Gerard[1], Blanford[2], Stoliczka[3], Griesbach[4], von Krafft[5], Hayden[6] and Diener[7], very little has been added to our knowledge about the stratigraphical details of the Spiti region. Though subsequent to Hayden's survey, Jhingran *et al.*[8] visited the area along with the third Royal Danish Expedition, their work has not been published.

The present authors visited the area during July–October, 1976, and carried out section measurement and systematic collection of palaeontological samples in order to establish upper Palaeozoic and Triassic biostratigraphy on modern lines as an item of the I.G.C.P. In the course of field work, four sections including the famous Lingti section were measured and a large number of mega-fossils and rock samples for micropalaeontological studies (especially conodonts) were collected.

The conodont studies were begun with the Permo-Triassic strata exposed on the left bank of Spiti river, about 1·5 km downstream from the confluence of Lingti river. The rock outcrop here appears to be the southward extension of those at Lingti and Lilang sections. In the stratigraphic section exposed, almost the entire known thickness of the conglomeratic and shaly, permian strata are overlain by a few metres of the predominantly limestone strata of the Lower Triassic. The rest of the Triassic section has been eroded.

It is interesting to note, as revealed by mega-faunal studies, that in the present section, the species of the Permian ammonoide *Cyclolobus*, viz., *C. oldhami*, *C. walkeri* and *C. kraffti*, along with *Xenaspis* cf. *carbonaria* occur in the well-known Productus shale at 8·13 m below its contact with the overlying limestone sequence. The basal limestone bed, in contact with the Productus shale, has yielded a well-preserved specimen of *Otoceras woodwardi*, an ammonoide species taken to mark the beginning of Scythian in the Spiti region.

A total of 14 rock samples (Fig. 1) were collected from the exposed Lower Triassic strata at suitable intervals. The samples were treated with 10% and 15% acetic acid for extraction of conodonts. All the limestone samples have yielded well preserved conodont elements. However, the samples, *viz.*, LLG19, LLG18, LLG17, LLG16 and LLG15 (Fig. 1) which come from intervening thin shale bands, mostly sandwiched between limestone strata, were found to be devoid of microfauna. The fossiliferous limestone samples have also yielded well preserved foraminifera, micro-molluscs and fish teeth. The foraminifera have been reported by the authors earlier[9]. Repeated search for the conodonts in the Productus shale has not borne any fruit so far.

Checklist of Conodont Elements:

1. *Anchignathodus* sp. cf. *A. typicalis* Sweet. 2. *Neogondolella carinata* (Clark). 3. *Ellisonia triassica* Muller. 4. *E. gradata* Sweet. 5. *E. nevadensis* Muller, 6. *E.* sp. cf. *E. tiecherti* Sweet. 7. *Hibbardella* sp. cf. *H. subsymmetrica* Muller. 8. *Neospathodus dieneri* Sweet. 9. *N. kummeli* Sweet. 10. *N. cristagalli* (Huckriede). 11. *N.* sp. n. sp. 12. *Xaniognathus curvatus* Sweet. 13. *X. deflectens* Sweet. 14. *X.* sp. n. sp. 15. "*Prioniodella prioniodellides*" (Tatge). 16. *Lonchodina* sp., *L. aequiarcuata* Muller.

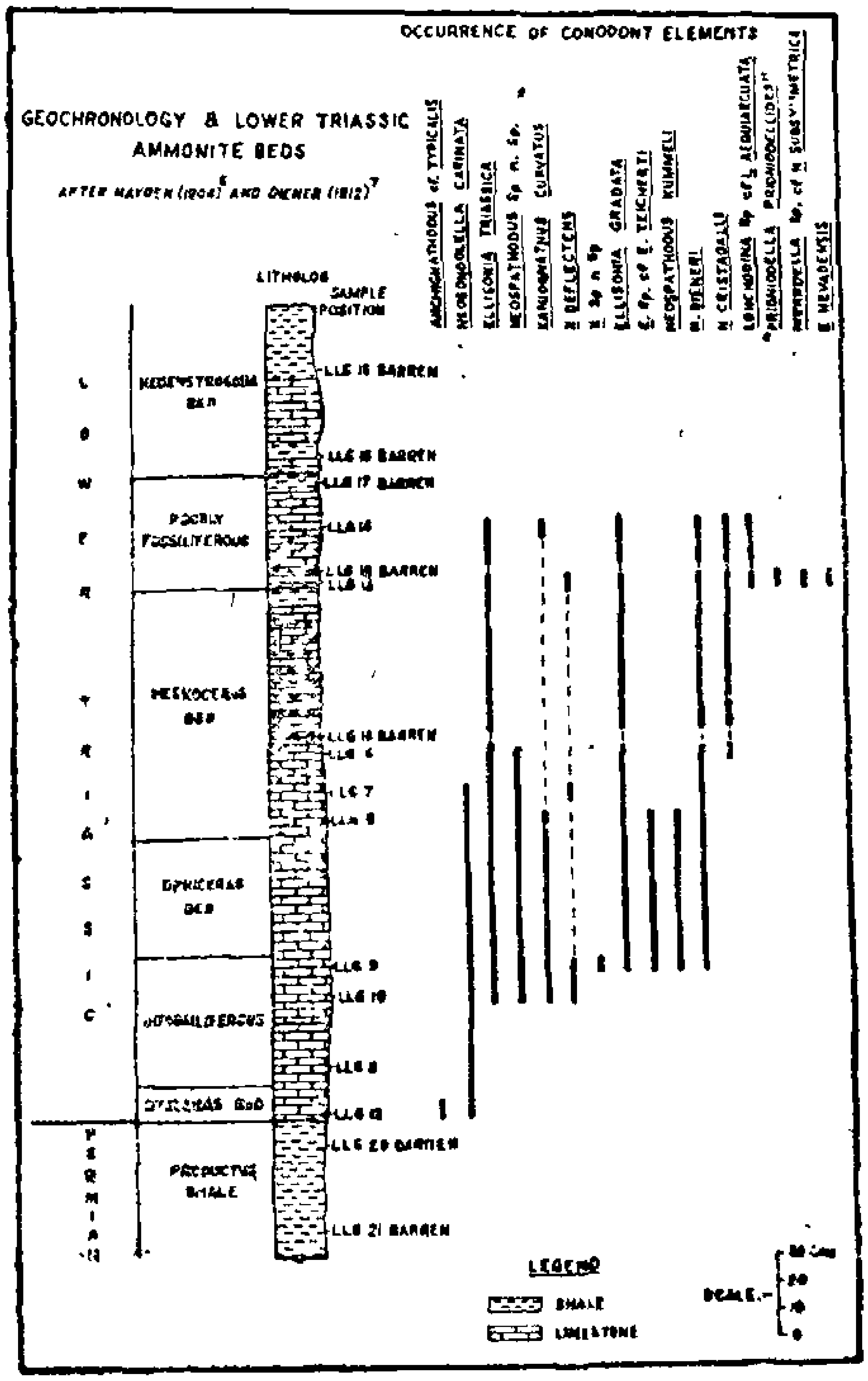

FIG. 1. Spiti river section. The vertical bold lines indicate sample-wise record of conodont elements and not necessarily the age ranges.

The above identifications of the conodont elements are based purely upon morphologic resemblences with the published photographs and descriptions of Muller[10] and Sweet[11], and are amenable to nomenclatorial change with changing generic concepts.

The assemblage indicates an age range from Griesbachian to Middle/Upper Dienerian in the Triassic time-scale of Silberling and Tozer[12].

The occurrence of *Neospathodus kummeli* in the assemblage from the Spiti river section is of significance in view of its biostratigraphic importance as lowest Dienerian guide species and its reported absence from the Lower Triassic of Kashmir (Sweet[13]) and from the Khar section in Pin valley (Goel[14]). Sweet[15], however, mentions the presence of this biostratigraphic guide species from the *Ophiceras* Bed in the section at Muth.

In addition to the extension of conodont studies into the famous Lilang area, the present study also brings out a preliminary correlation between the early Lower Triassic conodont zones and the classical ammonite-zones. Inference is also drawn that the occurrence of conodont elements is controlled by litho-facies.

The authors feel grateful to Dr. A. K. Chatterji, Palaeontologist-in-Charge, for encouraging the work and for critically going through the manuscript. For the identification of the broken element of *Anchignathodus* sp. cf. *A. typicalis*, the authors were assisted by T. Matsuda of Osaka City University Japan.

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April 30, 1977.

* Published with kind permission of the Director General, Geological Survey of India.

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MICROFAUNA OF THE SPITI SHALES (UPPER JURASSIC), MALLA JOHAR AREA KUMAON HIMALAYA, UTTAR PRADESH

THE Spiti Shale constitutes a well defined lithostratigraphic formation of the Tethyan sequence (Table I). These shales have yielded a well known ammonite fauna which gives Portlandian age (Heim and Gansser[3]). This note records for the first time a well preserved microfaunal assemblage of foraminifers and ostracods from the Spiti Shales exposed at Laptal camping ground, Pithoragarh District, U.P. The following forms have been identified:

FORAMINIFERS

Lingulina mallajoharensis Singh and Kumar n. sp., *Dentalina pseudocommunis* Franke., *Marginulina batrakiensis* (Myatliuk), *Marginulina* sp., *Lenticulina varians* (Bornemann), *Lenticulina muensteri* (Roemer), *Lenticulina* sp., *Saracenaria reesidei* Fox var. *shalshalensis* Singh and Kumar n. var., *Vaginulina constricta* (Terquem and Berthelin), *Pseudonodosaria laptalensis* Singh and Kumar n. sp., *Pseudonodosaria* sp., *Involutina* sp., *Eoguttalina* sp.

OSTRACODS

Bythocypris sp., *Monoceratina* sp.

This microfaunal assemblage resembles well with the Callovian-Oxfordian microfaunal assemblage of Egypt (Said and Barakat[6]), Europe (Gordon[1,2]) and North America (Loeblich and Tappan[4]). Heim and Gansser[3] have presumed a disconformity between the underlying Ferruginous Oolites (Callovian) and the Spiti Shale (Portlandian). The present microfaunal assemblage indicates that the lower age of the Spiti Shales may be Oxfordian and the presumed break in sedimentation after Callovian, may not at all be existing. Thus it may be suggested that there is a continuous sedimentation from the Ferruginous Oolites to the Giumal Sandstone (Table I).

TABLE I (After Heim and Gansser[3])

Upper Flysch (1,000 m)	Siliceous shales, black shales, red and green marls, chert and graywacke	Upper Cretaceous
Giumal Sandstone (600 m)	Glauconitic, calcareous and siliceous sandstone and shale	Lower Cretaceous
Spiti Shale (100 m)	Black shales and siliceous fossiliferous concretions	Portlandian
Ferruginous Oolites (1·5 m)	Dense limestone and shales with ferruginous oolite grains	Callovian
Laptal Series (60 m)	Lumechelle, brown limestone, and shales	Liassic

The Spiti Shales are predominantly a continental shelf deposit in which only pelagic forms of ammonites have been recorded. Representing the deep sea deposits, the overlying Cretaceous succession of Giumal Sandstone and Upper Flysch is completely destitute of megafossils. But well preserved microfaunal assemblage of *Globotruncana* affinity and radiolarian oozes are abundantly recorded in the Cretaceous succession (Heim and Gansser[3]; Mamgain and Sastry[5]).