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.

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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., *Veginulina 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]).

The discovery of rich benthonic microfauna from the Spiti Shales will throw new light on the distribution of microfaunal assemblage within the Tethyan Geosyncline and will help in inter-regional correlation.

The detail work is in progress and the systematics will be published shortly.

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SOME HISTOCHEMICAL STUDIES ON *CALICOPHORON CALICOPHORUM* AND *PARAMPHISTOMUM EPICLITUM* (PARAMPHISTOMATIDAE : DIGENEA: TREMATODA)

PARAMPHISTOMES form a major group of helminths which parasitize many ruminants and other livestock and the immature forms of which are the causative agents of the serious disease, paramphistomiasis. With a view to having a better understanding of the host-parasite relationships, some physiological studies applying histochemical techniques were made on *Paramphistomum epiclitum*[1] Fischoeder, 1904 and *Cotylophoron cotylophorum*[2] (Fischoeder, 1901) Stiles and Goldberger, 1910. The present work is a comparative study on *Calicophoron calicophorum* (Fischoeder, 1901) Näsmark, 1937 and *P. epiclitum*, both of which are the common parasites in the rumen of sheep and goats in Simla region.

The adult worms of *C. calicophorum* and *P. epiclitum* were collected from the rumen of sheep and goats slaughtered at the local abbatoir and were fixed in Carnoy, Rossman, Formol calcium and Bouin[3]. Paraffin sections, cut at a thickness of 5-7 μ were subjected to histochemical tests as summarised in Table I.

The distribution of carbohydrates, proteins and lipids was found to be almost the same in both the species studied (Table I). In view of the fact that both occupy the same habitat in the same host, this similarity indicates the relationship between the habitat and the type of the metabolism occurring in the parasite.

The tegument, both in *C. calicophorum* and *P. epiclitum*, was found positive for carbohydrates of 1 : 2 glycol group, glycogen, proteins and lipids. The carbohydrates of 1 : 2 glycol group have also been reported in the tegument of *Fasciola hepatica*[4] and in *P. epiclitum*[1]. Being in conformity with these, the present observations are contrary to some earlier reports[5-7]. The tegument is suggested to be the region of maximum carbohydrate uptake from the host[3]. Proteins have also been revealed in the outermost covering of other digenetic trematodes[8]. Besides having been demonstrated in the tegument of many digenea[6], the lipids have also been detected in the tegument in *Cotylophoron cotylophorum* which also parasitizes the same host and habitat as the worms under present studies. It seems likely that the transport of lipophilic substances takes place at this site[2].

Presence of glycogen, proteins and sudanophilic substances in the subtegument has also been reported earlier[9]. Singh and Gupta[1] found no proteins and lipids in this layer of *P. epiclitum* and glycogen was found to be missing by Axmann[5]. In view of the variations with regard to the occurrence of glycogen in this layer[6], the subtegument may be regarded as a temporary site for glycogen storage.

The parenchymal cells have also been found to be containing abundant glucogen[1,5,7,10] along with the carbohydrates of 1 : 2 glycol group and also a little amount of lipid and protein material. The parenchymal cells in the suckers, too, appear to be the important storage places[10,11].

The gut wall contains some carbohydrates[7] and lipids[12]. Lipids occurring in the lumen of gut may either be from the host diet or may represent the excreted metabolic products[2].

In both the species studied, the gametogonia and gametocytes were observed to be lacking in glycogen which was present in the mature sperm and uterine eggs only[5,7]. In the Mehlis' gland and vitellaria carbohydrates, proteins and some sudanophilic substances could be localized. Earlier, lipoproteins and phospholipids have been reported in the secretion of Mehlis' gland and proteins, in the vitellaria of *F. hepatica*[13] and *P. epiclitum*[1].

In accordance with many earlier observations[1,14-16] lipids were localized in abundance in the excretory system, indicating that such metabolic by-products are expelled from the body.

The presence of some sudanophilic material in the lymph vessels of these flukes may possibly be related with some excretory function performed by this system, as is suggested[2] in view of its presumed origin from the primary excretory tubules.