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TRACE FOSSILS FROM THE ?CAMBRIAN TAL GROUP, SIRMUR DISTRICT, H. P. AND PROPOSED REDEFINITION OF THE TAL

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ABSTRACT

Palaeophycus sp., *Skolithos* sp., and trilobite traces are reported from the Koti Dhaman Formation (=Upper Tal) in the Sirmur district, Himachal Pradesh. The first trace fossil and the trilobite traces occur over the sole of a pale white quartzite and *Skolithos* sp., in a siltstone bed.

The sediments enclosing these traces fossils were mainly deposited in intertidal sand facies with local bar channel conditions.

It is suggested that the term Tal be restricted to the sequence below the Shell Limestone and above the Krol Formation and the Shell Limestone be designated as the Nilkanth Formation.

INTRODUCTION

The paper records trace fossils *Palaeophycus* sp., *Skolithos* sp., and trilobite traces from the Lower Quartzite Member of the Upper Tal. The Upper Tal has been formally designated as the Koti Dhaman Formation whereas the Lower Tal and the Middle Tal as the Shaliyan and the Sankholi Formations respectively (Bhargava *et al.*, in press).

Palaeophycus sp., and triobite traces occur together on obverse face of a pale white micaceous quartzite (**Fig.** 1) exposed about 750m WNW of Kota (77° 34′; 30° 38′). The quartzite shows development of herringbone cross-bedding, large scale low angled (bar channel type) cross-bedding and current and oscillation types of ripple marks. *Skolithos* sp., has been found in the siltstone layers interbedded with the quarteite along the contact of the Lower Quartzite Member with the Sankholi Formation (Fig. 1) exposed about 1km NW of Skandon (77° 35′ 50″: 30° 37′). The siltstone shows tidal wavy, parallel and lenticular beddings.

The specimens are registered in the museum of the H. P. Circle, Geological Survey of India, Chandigarh.

DESCRIPTION OF TRACE FOSSILS

Ichnogenus Palaeophycus HALL 1847

Palaeophycus sp.

(Pl. I—1-3, fig. 2)

These are 1mm to 6 mm wide straight to gently curved vermiform traces some of which occur in clusters. Due to cross-overs of the traces a few tubes appear branched. The infilled material in the traces is similar to the enclosing rock.

Remarks : *Palaeophycus* is a wide ranging form known from sediments of various levels of Phanerozoic. It is often confused with *Planolites* Nicholson 1873.

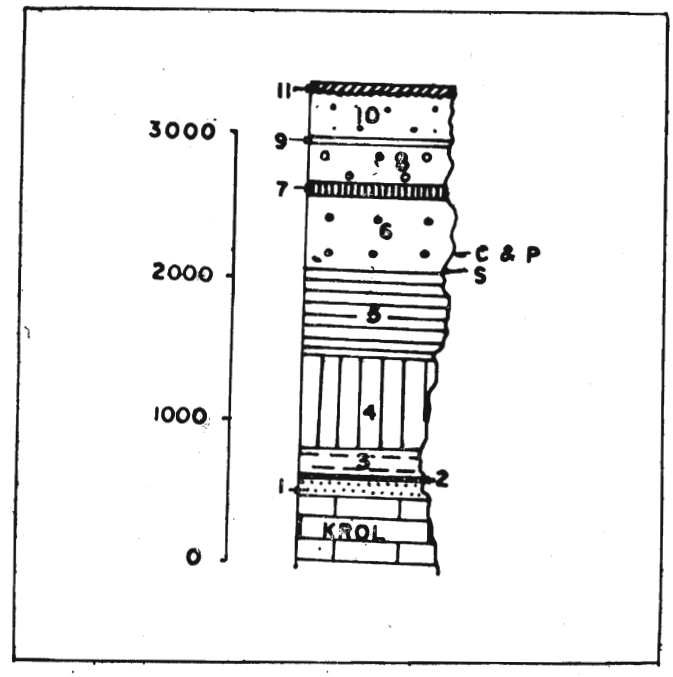

Fig. 1. Lithostratigraphic column of the Tal Group and the Nilkanth Formation. 1-10 Tal Group; 1-3 Shaliyan Formation, 1. Earthy Siltstone Member, 2. Chert Member, 3. Carbonaceous Member; 4-5. Sankholi Formation, 4. Quartz wacke Member, 5. Banded Siltstone Member, 6-10 Koti Dhaman Formation, 6. Lower Quartzite Member, 7. Shale Member, 8. Arkosic Sandstone Member, 9. Algal Limestone Member, 10. Upper Quartzite Member, 11. Nilkanth Formation. C. Trilobite traces; P. *Palaeophycus* sp.; S. *Skolithos* sp.

However, Pemberton and Frey (1982) distinguish it from *Planolites* by the filling material which in case of *Palaeophycus* is similar to the matrix of the rock enclosing it and also by presence of a lining in *Palaeophycus*. Though the infilled material in the present specimen is same as that of the host rock, the lining is only partially present.

Regd. No. MU. 42

Ichnogenus Skolithos HALDEMAN, 1840
Skolithos sp.
(Pl. I—4-5)

Circular vertical shafts having diameters between 2 mm and 6 mm extend vertically down to 0.5cm to 1.5 cm at 80° to 90° angles to the bedding plane. The shafts have a tendency to taper moderately towards the bottom. These truncate against an underlying quartzite. There is a dark extremely thin discontinuous lining along the shaft. The infilled material in planar view towards the top shows concentric structures. The infilled material is similar to the composition of the host rock.

Remarks : The traces are generally paired and could represent. *Arenicolites*. Since no complete 'U' shaped shaft in vertical section was observed, it has been referred here as *Skolithos*. The *Skolithos* is also reported from the Tal of the Mussoorie area (Singh *et al.* 1984).

Regd. No. MU. 39.

Trilobite traces
(Pl. I—1-3, fig. 2)

These traces are represented by 5-7 parallel straight to gently curved scratches separated by ridges arranged in distinct bundles which are 1-3 cm long, 0.7—1.2 cm wide and about 2-4 mm high. The ridges in the markings are 0.5 mm thick and about 2 mm apart. The bundles are irregularly developed some of which are paired (bilobed). The scratches in bilobed pairs do not form an acute angle and are disposed at angles varying between 150°-160°.

Remarks : These traces were discovered in 1967. The palaeontological data at that time heavily favoured an Upper Mesozoic age for the entire Tal Group (Bhargava, 1979). Thus despite a resemblance it was unthinkable to compare these markings with trilobite traces. These markings instead were compared with the ornamentation of *Trigonia* shells (Bhargava, 1978) with which they apparently resemble. However, this interpretation was never unequivocal.

Subsequently, a review by Singh (1981) exposed fallibility of various fossils in the Krol Formation and

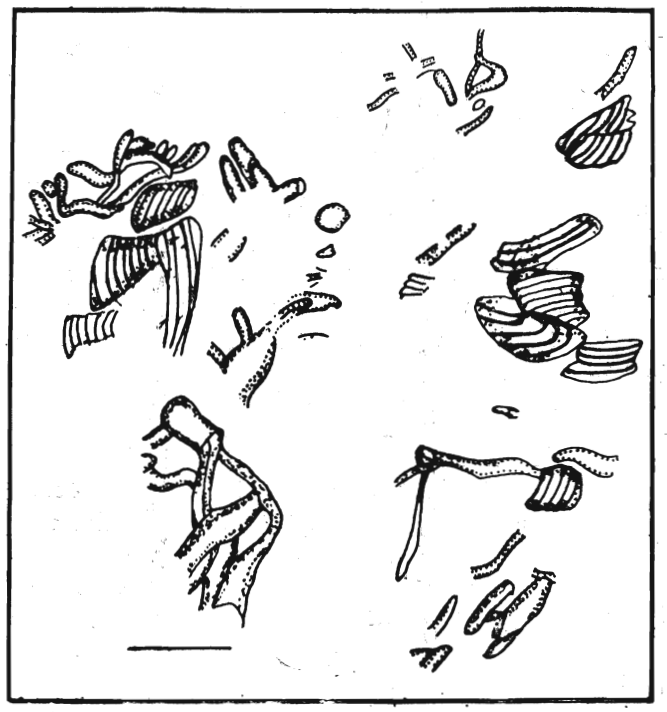

Fig. 2. Detailed sketch of a part of Pl. I—1 showing trilobite traces and *Palaeophycus* sp. Bar represents 2cm.

the Tal Group. Discoveries of Archaeocyatha from the uppermost part of the Krol Formation (Singh and Rai, 1983, 1984) and trilobite impressions from the Tal Group (Rai and Singh, 1983) convincingly place the upper most Krol Formation in the Lowermost Cambrian and the Tal Group in a somewhat younger position. This dramatically changed stratigraphic situation of the Tal Group now makes it possible to compare these markings with the trilobite traces.

Since many of the scratches are straight they superficially resemble *Monomorphichnus*. However, the bulged nature of bundles containing these markings and occurrence of quite a few of them in bilobed pairs over the same surface militates against such an identification. These markings also resemble *Cruziana fasciculata* Seilacher 1970. Due to shallow relief, equal and wider spacing of the ridges and wide angle at which these are disposed in lobed pairs these can be better compared with *Cruziana brannae* Crimes *et al.*, 1977, which is known from the Lower Cambrian of Spain (Crimes *et al.*, 1977) However, the present specimen is not typical enough to be categorically referred to this form either.

Regd. No. MU. 42.

Plate I—3 was photographed in 1967. Since then a part of the specimen got broken. Plate I—1 shows the remaining specimen (upper half of fig. 3),

ENVIRONMENT OF DEPOSITION

CM curves (Passega, 1957) for the Lower Quartzite Member indicate beach environments. The presence of large scale cross-bedding and herringbone cross-bedding as well as current and oscillation ripple marks distinctly place these rocks in inter-tidal sand facies. The low angled large scale cross-bedding indicates local bar channel conditions. The wavy and parallel beddings in the siltstone enclosing *Skolithos* sp., point to a similar environment of deposition. The presence of detrital mica in the quartzite suggests rapid sedimentation due to which winnowing action could not be completed.

PROPOSED REDEFINITION OF THE TAL GROUP

The term Tal Limestone was first used by Medlicott (1864) for a sequence in the Tal Valley. Middlemiss (1885) described that the 'Tal Limestone' was not all limestone but also included large amount of quartzite. Subsequently, he (Middlemiss, 1887) designated it as the Tal beds and subdivided them into lower and upper parts; the lower part included carbonaceous shale and quartzite and the upper subdivision comprised quartzite and fossiliferous limestone (=Shell Limestone). Auden (1934, 1937) also subdivided the Tal Beds into the lower and upper, however, his upper subdivision included the upper and almost the entire lower parts of Middlemiss (1887).

Discoveries of shelly microfossils (Azmi *et al.*, 1981; Bhatt *et al.*, 1983) in the basal Tal (Shaliyan Formation) indicate a Lower Cambrian age for the Shalliyan Formation and trilobite from the overlying sequence (Rai and Singh, 1983) a somewhat younger age. The Shell Limestone on the other hand contains Cretaceous fossils (Tewari and Kumar, 1968; Bhatia, 1980; P. Singh, 1980). The Shell Limestone and the underlying sequence thus represent vastly different ages. These, therefore, cannot be classified under the same group. As suggested by Singh (1979), the Shell Limestone should be delinked from the remaining sequence. Once this is done, the question arises which sequence should inherit the name Tal ? Of these, the Shell Limestone is exposed only in small areas of Mussoorie and Garhwal Synclines while the quartzite is more extensively developed in the Korgai, Nigali dhar, Mussoorie and Garhwal Synclines. This quartzite part of original Tal of Middlemiss, (1887) and conformably underlying phosphorite have been widely referred as the Tal Formation and the Tal Phosphorite. In subsequent stratigraphic controversies it was the sequence below the Shell Limestone that has been repeatedly and unanimously referred as the Tal by various workers (Azmi *et al.* 1979; Bhatt *et al*, 1983; Rai and Singh, 1983; Singh and Rai, 1983; Singh *et al.*, 1984). In view of above, it is advocated that the name Tal may be retained for the phosphatic, argillaceous and arenaceous sequences which in Himachal have been classified as the Shaliyan, Sankholi and Koti Dhaman Formations and which in Mussoorie and Garhwal are developed in between the Krol and the Shell Limestone. The Shell Limestone as suggested by Singh (1979) can be named as the Nilkanth Formation.

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EXPLANATION OF PLATE

PLATE I

1. Quartzite specimen showing trilobite traces which are placed in irregular bundles (T) and *Palaeophycus* sp. (P.).
2. Enlargement of left part of the above specimen showing details of trilobite traces comparable with *Cruziana brannae* Crimes *et al.* 1977.
3. Original specimen now broken. 1 represents upper half of this specimen.
4. *Skolithos* sp. along the bedding plane of a siltstone bed. The concentric structure in the infilled material can be seen in several burrows.
5. *Skolithos* sp in vertical section traced from a polished specimen.

Bar represents 2 cm.