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Some trace fossils from the Subathu rocks of Nilkanth, Pauri-Garhwal, Himalaya

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Abstract

Some well-preserved star shaped, cylindrical, curved, horizontal and vertical burrow like structures in the green and purple coloured shales of the Subathu rocks of Nilkanth are described. Most of these structures are mud-lined, smooth surfaced and have relatively low densities and localised occurrence. These structures recognised as trace fossil burrows of *Thalassinoides, Palacophycus* and *Planolites*. Possible Palaeo-environments in which the trace making communities lived are indicated.

Introduction

Green and purple coloured shales of Subathu sedimentary unit are well exposed around Nilkanth (N. Lat. 30°4'47"; E. Long. 78°20'35") situated about seven kilometres east-southeast of Rishikesh in Pauri-Garhwal, Himalaya. These rocks are fossiliferous and contain well-preserved fossils of pelecypods, gasteropods, echinoderm spines, coral fragments and microfossils of foraminifera, Ostracoda, and algae. On the basis of these fossil forms an Upper Paleocene to Middle Miocene age has been assigned to these rocks.

In the past, number of workers (Pant, 1962; Tewari and Kumar, 1967; Tewari and Singh, 1976; Singh, 1978; Mathur, 1978, 1979; Shah *et al.*, 1980;) have investigated the Subathu sediments of Kumaun and Garhwal Himalaya. Most of their reports are on biostratigraphic, Palaeontologic and depositional aspects. In the present study the authors report some biogenic sedimentary structures in the Subathu rocks of Nilkanth. These structures are developed in the green and purple coloured Subathu Shales and resemble star-shaped, fan-shaped, cylindrical and curved objects. Most of these forms are mud-lined, smooth surfaced and have relatively low densities and localized occurrence.

Biogenic structures

Star-shaped forms: These are well preserved on the bedding surfaces and consist of star-like configurations (Photos 1 and 2). The more complete specimens are approximately five to seven cm in diameter. The central portion is depressed in

EXPLANATION OF PHOTOS AND FIGURES

Photo 1 and Figure 1.

Star shaped, fan shaped and pear shaped burrow forms. Nodular rays of star shaped and fan shaped varieties are seen fused. These structures are interpreted as *Thalassinoide* burrows intercrossing and overlapping each other.

Photo 2 and Figure 2.

Top left corner - star shaped object (damaged); Top right corner - pear-shaped burrow; Central portion - Curved tubular form interpreted as *Palacophycus*.

Photo 3 and Figure 3.

Thalassinoide and *Planolite* burrow structures. Note the horizontal elongate burrow is refilled with fine grained rock matrix. Minor branching is seen at the right side bottom corner.

Photo 1

Photo 2

Photo 3

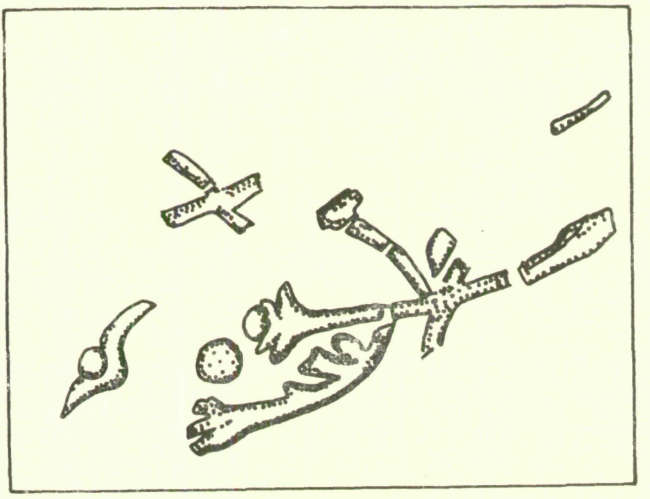

Figure 1.

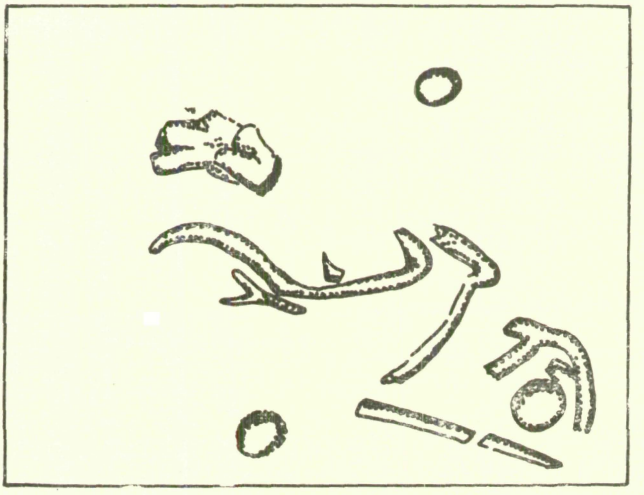

Figure 2

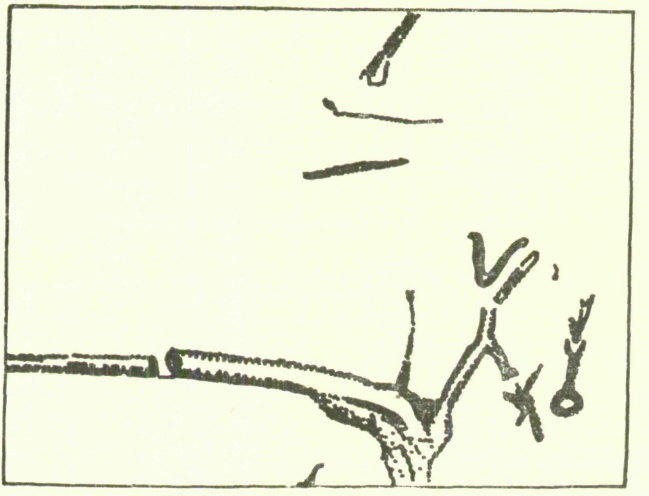

Figure 3.

the form of a small disc approximately 1 to 1.5 cm in diameter. A well-preserved specimen contains between four and five long slender irregularly developed nodular rays, some of these ending abruptly. Some of the rays are seen passing over each other and then appear to be fused completely. Interlocking or fusion with slender fan-shaped bodies is common (Photo 1).

Fan-shaped structures: These objects are found fused with the previously described star-shaped structures. The nodular surface of the fan-rays are irregular and blunt. Most of these rays end abruptly. Adjacent to these structures are four vertical burrow structures (Photo 1). Most of these structures are found flattened and deformed.

Vertical, horizontal, and curved burrow-like structures: Straight to gently curved and horizontal burrow-like structures are very common. Branching can be observed in some of these structures. Most of the large-sized burrows are filled with fine-grained matrix. Length of these burrows is, however, variable, while the diameters of such forms averages between three to four centimeter (Photos 1, 2, 3). Along with these large-sized varieties some small wrinkled burrow structures are also seen (Photo 3).

Identification

The bio-sedimentary structures located within the Subathu sediments of Nilkanth are all mud-lined, smooth surfaced, have relatively low densities and localized occurrence. Some of these structures are partially removed by erosion or are destroyed by bioturbation making it difficult to identify at their ichnospecies levels. Differential preservation in addition to the sediment compaction and deformation has further added to the difficulty in identification. The biogenic sedimentary structures, therefore, are identified to their generic levels only.

Considering their gross morphology and apparent patterns of development, the structures could be attributed to such ichnogenera as *Gothaviella, Sewardiella, Scoyenia, Palacophycus, Planolites* and *Thalassinoides.*

Gothaniella Fucini (1936)

These are small and rosette shaped objects having a number of petalloid nodular rays. Interlocking of adjacent structures is not seen in these forms. Hantzschel (1962, Fig. 147-4, p. 237) grouped these structures with categories of 'fossils' probably of inorganic origin resulting from concretions, clay galls, various trail like markings and even mudcracks and structures of diagenetic origin.

Most *Gothaniella* forms according to Fücini (1936), occur together with bigger and more pronounced structures called *Sewardiella.*

Sewardiella Fücini (1936)

These are stamped impressions resembling Palm branches, fans or rosettes on bedding planes, (Hantzschel 1962, Fig. 146-5, p. 235). Controversy exists concerning the identification of *Gothaniella* and *Sewardiella.* These forms are variously interpreted by Fücini (1936) as algae, by Sacco (1940) as ?Sphenophyllum and by Pia (1937) as probably inorganic in origin. See Nilkanth structures (Photos 1, 2).

Scoyenia White, (1929)

These are slender rope-like remains on half relief or flattened forms on the bedding planes. They are usually 2 to 5 mm in diameter, (Häntzschel 1962, Fig. 132-5, p. 212).

Palacophycus Hall (1847)

These are cylindrical, straight to gently curved, horizontal, branched or unbranched burrows. Development of these structures is parallel or slightly oblique to the stratification. Walls of these structures are somewhat irregular. Burrow fill is structureless and lithologically identical to the surrounding matrix. Width and length of individual burrow is variable (Photos 2 and 3). Our structures can be compared with Pickerill, (1979, Fig. 9 a, p. 2021) and Frey (1972, Plate 3 D. F.)

Planolites Nicholson (1873)

Planolites are unbranched, unornamented, straight or sinuous, cylindrical to subcylindrical burrows with smooth to slightly crinckled walls. These are developed parallel or slightly inclined to the bedding surfaces. The Nilkanth forms are small horizontal to sub-horizontal, about two to four mm in length, and are poorly preserved (Photo 3). These structures can be compared with Frey and Chowns (1972, Plate 3 H. K.) and Pickerill (1979, Fig. 9 F, P. 2031).

Thalassinoides Ehrunberg (1944)

These are branched burrows with burrow system consisting of numerous rectifying shafts, tunnels and irregularly inclined burrows. Y-shaped forking is most common. Pear-shaped cavities are sometimes observed. The burrows are 1 to 2.5 cm in diameter. Nilkanth Photographs, 1, 2, 3. These structures can be compared with Häntzschel (1962, Fig. 136-6, p. 217).

Discussion

The Nilkanth biogenic sedimentary structures observed in photographs 1, 2 and 3 (see captions) exhibit close similarities with the ichnogenera *Thalassinoides Palacophycus* and *Planolites* respectively. As for the star-shaped and fan-shaped structures comparison could be made with *Gothaniella, Sewardiella* and *Scoyenia.* The first two forms are referred by Häntzschel (1962) as 'fossils' of doubtful origin and their formation has been attributed even to some inorganic processes by him. The Nilkanth forms, however, exhibit marked differences with these forms especially in regard to their number of nodular rays; in the possession of a central disc and an interlocking arrangement with the adjacent fan-shaped structures. These structures are not as slender and rope like as to be truly called as *Scoyenia.* These forms therefore may not be *Gothaniella, Sewardiella* or *Scoyenia.* On the other hand, close association of the fan-shaped, star-shaped forms with well preserved burrow structures including *Thalassinoides, Palacophycus,* and *Planolites* leads the authors to infer that these structures are *Thalassinoides* burrows originally intercrossing or superimposed over each other.

Considering the available evidences it is concluded that the Subathu sediments of Nilkanth, supported a variety of burrowing organisms. Similar conclusions have been reached independently by Singh (1978) from his studies of the Subathu rocks of Simla Hills, Himalaya. He reports a number of trace-fossils including *Thalassinoides, chondrites, Tiggillites* and *Skolithos* from these rocks.

Presence of Pelecypods, gasteropods etc. indicate that the deposition took place in well oxygenated waters. Non-development of any primary sedimentary structures could be attributed to the effects of bioturbation.

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References

FREY, R. W., and CHOWNS, T. W., (1972) Trace fossils from the Ringgold road cut (Ordovician and Silurian), Georgia. Chowns, T. M. (compiler), Sedimentary environments in the Paleozoic rocks of northwest Georgia; *Georgia Geol. Surv. Guide book*, v. 11, pp. 25-55.

HANTZSCHEL, W., (1962) Trace Fossils and Problematica, L. C. Moore (Ed. in Treatise in Invertebrate Palaeontology. *Part W, Miscellanea W 177 to W 245.*

MANDWAL, N. K., (1959) Smaller Foraminifera from the Subathu beds near Dharampur, Simla Hills. *Jour. Geol. Soc. India*, v. 1, pp. 156-166.

MATHUR, N. S., (1978) Biostratigraphical aspects of the Subathu Formation, Kumaun Himalaya. *Recent Res. in Geol.*, v. 5, pp. 96-112.

——— (1979) Palaecology of the Subathu Formation, Kumaun Himalaya. *Bull., Indian Geol. Assoc.*, v. 12(1), pp. 81-90.

PANT, S. C., (1962) Lower Tertiary Formations of Simla-Garhwal Himalaya. *Indian Miner.*, v. 16, p. 306.

PICKERILL, R. K., and FORBES, W. H., (1979) Ichnology of the Trenton Group in the Quebec city area. *Canadian Journal of Earth Sciences*, v. 16, pp. 2022-2039.

SHAH. A. N, DHONDIYAL, K., PATEL, R. P., SRINIVAS, S., RAWAL, Y. B. and SHRINGARPURE, D. M., (1980) The debatable age of Nilkanth rocks. *Abstract VIII Indian Colloq. on micropalaeontology and Stratigraphy.*

SINGH, I. B., (1978) On some sedimentological and palaeoecological aspects of Subathu-Dagsai-Kasauli successions of Simla Hills. *Jour. Palaeont. Soc. India*, v. 21-22, pp. 19-28.

TEWARI, B. S. and KUMAR, R., (1967) Foraminifera from Nummulitic beds of Nilkanth and organic remains from Tal limestones, Garhwal Himalayas. *Pub. Cent. Adv. Stud. Geol. Punjab Univ.*, v. 3, pp. 33-42.

TEWARI, B. S. and SINGH, J., (1976) Microfossils and the age of the Subathu Formation of Dogadda, Garhwal Himalayas. *Jour. Geol. Soc. India.* v. 17, pp. 409-411.

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