# SHELLY MICROFOSSILS OF TOMMOTIAN AGE (LOWER CAMBRIAN) FROM THE CHERT-PHOSPHORITE MEMBER OF LOWER TAL FORMATION, MALDEOTA, DEHRA DUN DISTRICT, UTTAR PRADESH

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## ABSTRACT

The paper records a prolific assemblage of Shelly Microfossils of mostly phosphatic composition, referable to Tommotian age, from the Chert-Phosphorite Member of Lower Tal Formation, exposed in PPCL Mines at Maldeota, near Dehra Dun. The record of this microfossil assemblage confirms an early Cambrian age for Chert-Phosphorite Member of Lower Tal Formation.

## INTRODUCTION

In view of the current controversy on the age of Krol, Tal and other litho-units of Krol belt an investigation was started by the Palaeontology Division, Northern Region, GSI, entitled "Evaluation of the Chronostratigraphic position of Krol Belt sediments". Initially field work was undertaken in Mussoorie area of U. P. Himalaya, Dehra Dun District, in February, 1983. Samples collected by two of us (VDM & RSM) from the Chert-Phosphorite Member of Lower Tal Formation (Ravi Shanker, 1971) exposed in Adit no. 1, at 815 and 825 m levels of the mines of M/s Pyrites, Phosphates and Chemicals Ltd. (PPCL) at Maldeota, 14 km northeast of Dehra Dun, have yielded a well-preserved assemblage of Shelly Microfossils, which form the subject of present note.

## MATERIAL

The Adit no. 1 of the PPCL mines at Maldeota, at 815 m level, cuts through a complete succession of Chert-Phosphorite Member, with about 1.20 m of Krol limestone at the base and dark grey to black shale at the top; only the basal part of the black shale is exposed in the Adit, as rest of it has been timbered. The chert-phosphorite-black shale succession is together included in the basal part of Lower Tal Formation. This sequence was channel-sampled at 40 cm and 20 cm intervals, as shown in fig. 1.

At 825 m level of Adit No. 1, along the sampling line the thickness of the main phosphorite body was measured to be 2.20 m; this reduced thickness indicates uneven facies of the phosphatic level. Channel samples were collected from this level also at 20 cm interval (Fig. 1).

## PROCESSING OF THE SAMPLES

About 1 kg from each sample was kept in 10 per cent acetic acid bath for a period of three to four weeks, with acid being changed every week. After washing and drying, about 20 gm to 30 gm of washed residue was recovered from each sample which was floated in bromoform to isolate the microfossils.

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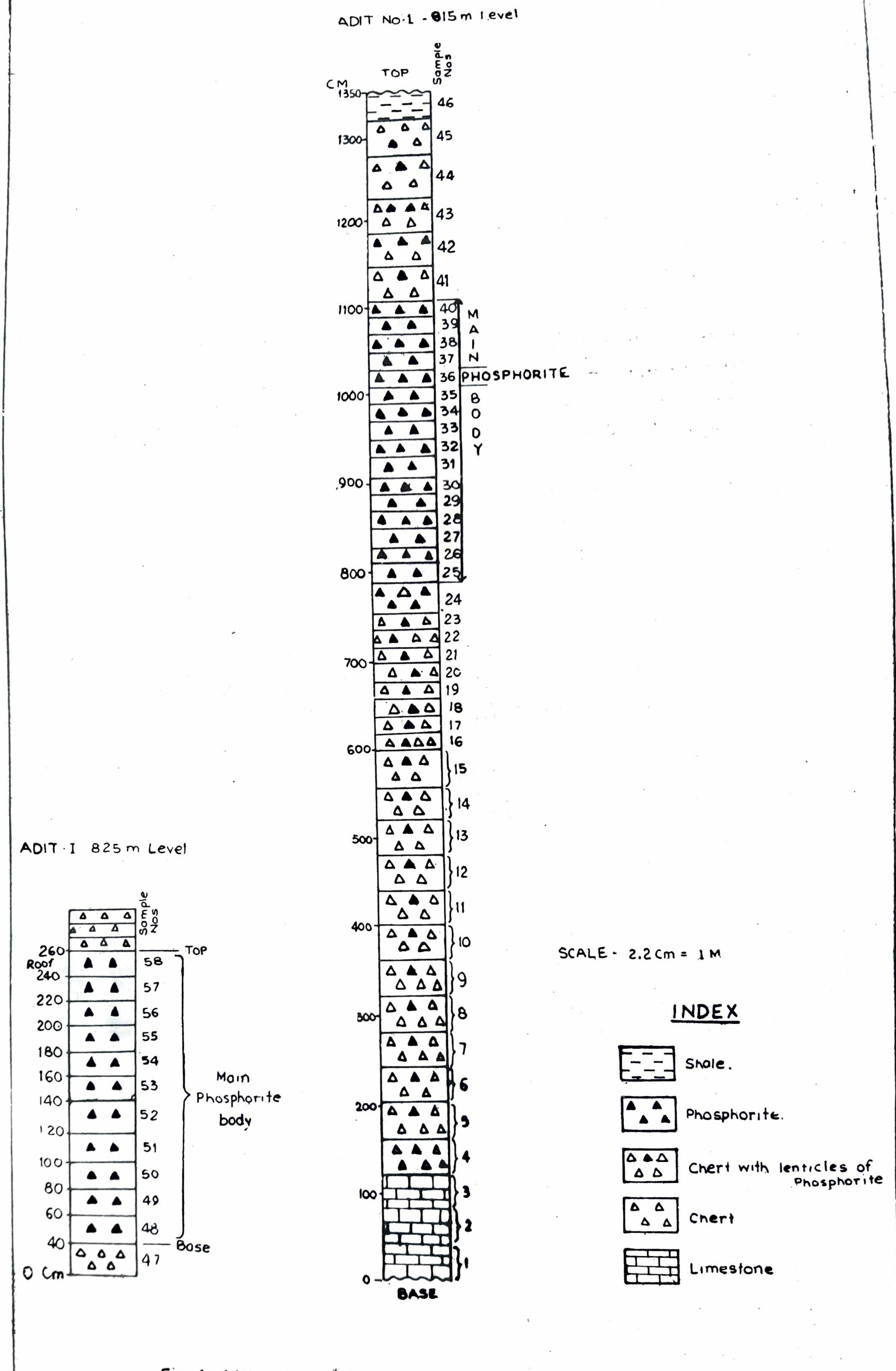


Fig·1 Lithocolumn of Moldeota phophorite mines

## MICROFAUNA

All the 16 samples (nos. 25 to 40; Fig. 1) collected from the main phosphorite body at 815 m level have yielded Shelly Microfossils, including protoconodonts/conodonts. The same is true for the 11 samples (nos. 48 to 58; Fig. 1) collected from 825 m level. However, the frequency of fossil occurrence varies considerably at different levels of the phosphorite body. The three samples (nos. 1 to 3; Fig. 1) from the top of Krol limestone have not yielded any microfauna. Some random samples analysed from below and above the main phosphorite body (nos. 12, 41, 42, 45, 47, etc.; Fig. 1) have, however, also yielded Shelly Microfossils. More samples are still in various stages of preparation and further work is continuing.

Some of the recovered Shelly Microfossils were powdered and tested with standard Shapiro's solution, and were found to be phosphatic in composition.

At this stage of work, the following assemblage of microfossils has been identified (Plates 1 & 2). The fossil material is presently stored in Palaeontology Division, GSI, NR, Lucknow.

*Sachites* sp. 1; *Sachites* sp. 2; *Sachites* sp. 3; *Trapezotheca* sp. 1; *Trapezotheca* sp. 2; *Circotheca* sp. 1; *Circotheca* sp. 2; *Hyolithellus tenuis* Missarzhevsky; *Olivooides* aff. *alveus* Qian; *Fomitchella* sp.; *Coleolella* aff. *billingsi* (Syssoiev); *Parapunctella* sp.;? *Adversella* sp.; *Protohertzina* sp.; *Hertzina* sp.1; *Hertzina* sp.2; Problematicum 1; Problematicum 2; Problematicum 3; Problematicum 4; Problematicum 5; Problematicum 6.

The above assemblage is comparable to the Tommotian (basal Cambrian) microfauna of Russian Plateform and Meishucun microfauna of Chinese sections, and corresponds to the trilobite-lacking basal part of Cambrian of Russia, China, Poland, Sweden and England (Raaben, 1969; Bengtson, 1968, 1970; Matthews and Missarzhevsky, 1975); Jicheng *et al.*, 1980; Huilin *et al.*, 1982); this constitutes the first recognised record of Tommotian microfauna from India.

The presence in the assemblage of *Circotheca, Coleolella* aff. *billingsi, Fomitchella, Protohertzina, Hyolithellus tenuis*, etc., is significant inasmuch as to indicate the affinity of the microfauna to the lower part of Tommotian Stage of Russian Platform. However, the presence of orthothecid genus *Trapezotheca*, which is also present here, is taken to characterise the upper part of Tommotian Stage in Russian sections. Accordingly, the lower range of this genus may have to be revised; and this is more so because of the absence of other typical genera of upper part of Tommotian in the microfauna of Chert-Phosphorite Member, as revealed by the investigations carried out so far. The absence of typical forms of the genus *Anabarites* (Family Incertae) in the microfauna of Chert-Phosphorite Members imparts the present microfauna a peculiarity of its own. To add to this distinctness, the genera of Family C menidae are also absent. In addition, certain other forms, viz. Probalematicum 5 and Probalematicum 6 (Plate 2), pre-dominate in the microfauna. The study carried out so far reveals some observations made above; however, it is apparent that the Tommotian microfauna of Chert-Phosphorite Member of lower Tal Formation has an indigenous character.

## DISCUSSION

The Krol-Tal sequence of Lesser Himalaya has been traditionally considered to be of Mesozoic age (Auden, 1934). Of late, however, some interesting microfossil finds (Patwardhan & Ahluwalia, 1975; Ahluwalia, 1978; Patwardhan, 1978; Pratap Singh & Shukla, 1981; Azmi *et al.*, 1981) from basal Chert-Phosphorite Member of

Lower Tal Formation have led to re-thinking concerning the chronostratigraphic position of this sequence which lacks undoubted body fossils (SINGH, 1981).

The thin-section photographs of the microfauna published by PATWARDHAN AND AHLUWALIA (1975), AHLUWALIA (1978) and PATWARDHAN (1978) are here considered to represent sections of different Tommotian genera of Family Circothecidae (PATWARDHAN & AHLUWALIA, 1975, figs. 4, 7; AHLUWALIA, 1978, fig. 1b; PATWARDHAN, 1978, fig. 1), family Hyolithellidae (PATWARDHAN & AHLUWALIA, 1975, fig. 7) and Family Coleollidae (PATWARDHAN & AHLUWALIA, 1975, fig. 2). Some other forms illustrated by these workers (PATWARDHAN & AHLUWALIA, 1975, figs. 1, 3, 5, 6; AHLUWALIA, 1978, figs. 1a, 1c) may be indigenous problematica. The microfossils recorded by PRATAP SINGH AND SHUKLA (1981), also from 825 m level of Maldeota PPCL mines, bear a close resemblance with our material, though these workers infer their record to represent remains of internal hard parts of annelids. Although we have not seen their fossil material (PRATAP SINGH & SHUKLA, 1981), their illustrations compare closely with the forms recorded by us and we have no hesitation to visualise the similarity of both the records, the only difference being in identification. In plate I of PRATAP SINGH AND SHUKLA, (1981) figs. 32-35 illustrate *Fomitchella*, figs. 36-58 illustrate some hyolithid genera, including *Circotheca* at figs. 42, 57 and *Hyolithellus tenuis* Missarzhevsky at fig. 58, figs. 4-17 and 20-22 illustrate possibly two species of Meishucun genus *Spirellus*, viz. *S. columnorus* Jiang (figs. 7, 8, 21, 22) and *S. tarsus* Jiang (figs. 4-6, 9-17, 20) and restof the figures illustrtates some indigenous problematica. In plate II (PRATAP SINGH & SHUKLA, 1981) figs. 1-37 and 39-47 mostly illustrate hyolithid genera, including *Circotheca* at figs. 3, 4, 24-26, 29-35, ? *Coleolella billingsi* (Syssoiev) at figs. 36, 42-47, ? *Ovalitheca* at fig. 39 and *Hyolithellus tenuis* Missarzhevsky at fig. 37; figs. 54-58 illustrate *Fomitchella*, figs. 74, 75, 79, 83-85 illustrate longitudinal and transverse sections of hyolithids and rest of the figures illustrate indigenous problematica. AZMI *et al.* (1981) have identified the Tommotian genera, several of them belonging to the Family Circothecidae (AZMI *et al.*, 1981; plate I, figs. 2, 6, 9, 10, 11), as younger conodonts/protoconodonts. Forms illustrated in figs. 2, 6, 11 (plate 1; AZMI *et al.*, 1981) could be referred to the genus *Circotheca*, the form illustrated in fig. 9 could be referred to the genus *Trapezotheca* and the forms in figs. 3, 4 could possibly represent *Protohertzina*.

The present study, however, clearly shows that the microfossils recovered by us are mostly phosphatic in composition and many of them are identical to forms reported by Russian and Chinese workers from Tommotian strata (RAABEN, 1969; JICHENG *et al.*, 1980; HULLIN *et al.*, 1982).

## CONCLUSION

In view of the present record of the Shelly Microfossils of Tommotian age and the discussion above, it is difficult to escape the conclusion that the lower part of the Tal Formation, particularly the basal Chert-Phosphorite Member, undoubtedly represents Tommotian Stage, i. e. the trilobite-lacking basal Cambrian.

Consequently, the traditional views on the age of Krol and other underlying formations will have to be revised and the Precambrian-Cambrian boundary may have to be placed between the uppermost Krol and the Chert-Phosphorite Member of Lower Tal Formation. Vertical distribution of the present Tommotian microfauna stratigraphically below and above the studied samples is yet to be ascertained in future work, which will also entail re-definition of Tal Formation.

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POST-SCRIPT

Since the submission of the manuscript to the press forms akin to gastropoda of the Family Pelagiellidae and comparable to the genus *Aldanella* have been recorded from sample no. 27. The Meishucun genus *Spirellus* has also been recorded.

## EXPLANATION OF PLATES

PLATE 1

1. *Protohertzina* sp., sample no. 48, ×40.
2. *Circotheca* sp. 1, sample no. 51, ×40.
3. *Circotheca* sp. 2, sample no. 51, ×40.
4. *Trapezotheca* sp. 1, sample no. 51, ×40.
5. *Trapezotheca* sp. 2, sample no. 51, ×40.
6. *Trapezotheca* sp. 3, sample no. 51, ×40.
7. *Fomitchella* sp., sample no. 49, ×40.
8. *Hertzina* sp. 1, sample no. 48, ×40.
9. *Hertzina* sp. 2, sample no. 48, ×40.

10-13. Problematicum 1, sample no. 47, ×40.

14. Problematicum 2, sample no. 51, ×40.

15-16. *Coleolella* aff. *billingsi* (Syssoiev), sample no. 48, ×30.

17-18. *Olivooides* aff. *alveus* Qian, 17, sample no. 53, ×40; 18, broken shell showing the shell wall, sample no. 47, ×60.

PLATE 2

1, 6. *Sachites* sp. 1, sample no. 35, ×40.

2. *Sachites* sp. 2, sample no. 47, ×40.
3. *Sachites* sp. 3, sample no. 51, ×20.
4. *Hyolithellus tenuis* Missarzhevsky, sample no. 55, ×40.
5. *Parapunctella* sp., sample no. 48, ×20.
7. Problematicum, 3, sample no. 47, ×40.

8, 14. Problematicum 4, sample no. 47, ×40.

9. ? *Adversella* sp., sample no. 35, ×40.

10-11. Problematicum 5; 10, sample no. 48; 11, sample no. 51; ×40.

12-13. Problematicum 6; 12, sample no. 45; 13, sample no. 51; ×40. These resemble closely to those illustrated by Mostler (1980; Problematikum 2, Tafel 2, fig. 14, 17).