CORRESPONDENCE AND NOTES

Skeletal microfauna of Meishucunian and Qiongzhusian (Precambrian–Cambrian boundary) age from the Ganga Valley, Lesser Himalaya, India

GOPENDRA KUMAR*, D. K. BHATT* & B. K. RAINA†
*Geological Survey of India, Lucknow, 226 006, India
†Geological Survey of India, Jammu, 180 004, India

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Abstract – The earliest skeletal microfauna of Precambrian–Cambrian age recovered from the 'Lower Tal' sequence (Chert-Phosphorite to Calcareous members) of the Tal Formation, exposed in the Ganga Valley, Lesser Himalaya, Uttar Pradesh, India, has been grouped into three assemblages. In ascending order these are: assemblage I, containing *Anabarites trisulcatus* Missarzhevsky, *Tiktiteca korobovi* (Miss.). *Circotheca* sp., *Turcutheca* sp., *Spirellus columnorus* Jiang and Olisooides alveus Qian; assemblage II, yielding *Allota erromenosa* Jiang, A. sp. cf. *A. erromenosa* Jiang, *Dimidia simpleca* Jiang, D. sp. cf. *D. simpleca* Jiang and *Hyolithellus* sp.; and assemblage III, comprising *Pelagiella* lorenzi Karabayashi, *Uriculatespira* madianensis Zhou & Xiao and *A. undunca* He & Pei. The assemblages I and II are correlatable to the Meishucunian Zone I and Zone III respectively, and the assemblage III to the Qiongzhusian Stage of China. Thus the 'Lower Tal' sequence is assigned to Precambrian–Cambrian age.

1. Introduction

The Tal Formation, in the Blaini-Krol-Tal succession of the Krol Belt in western Lesser Himalaya (Auden, 1934, 1937), is an important lithostratigraphic unit well known for phosphate deposits at its base. It conformably overlies the Krol Formation (E Member) and is transgressively overlapped either by the Early Permian Boulder Slate sequence (Waterhouse & Gupta, 1978; Bhatt & Singh, 1981) or the Cretaceous–Palaeocene Tal Shell Limestone (Manikot Shell Limestone/Nilkanth Formation). The sequence of the Tal Formation is exposed in the Garhwal, Mussoorie, Korgai and Nigalidhar synclines, and is divisible into Chert-Phosphorite, Argillaceous, Arenaceous, Calcareous members in ascending order (Shanker, 1971; Kumar & Dhaundiyal, 1979). The first four members constitute the lower 'Lower Tal' and the Phulchatti Member corresponds to the 'Upper Tal' sequence (Atdabanian level). The present record of the varied microfauna consisting of earliest skeletal fossils, many of them now having their first record from the Himalayan region, includes several zonal guide fossils from the earliest Meischucunian Stage to the Qiongzhusian Stage of the Precambrian–Early Cambrian sequences of China.

2. Lithostratigraphy

A good and easily accessible exposure of the entire Tal Formation is available for examination on Rishikesh–Deoprayar Highway, on the right bank of the Ganga River between Kauriyala and Singtali villages (Fig. 1). In this section, the basal Chert-Phosphorite Member of the Tal Formation, conformably overliving the calcarceous sequence of the Krol Formation (Krol E), consists of chert (0.9 m)
and friable sandstone (0.61 m) with streaks of phosphorite. The Argillaceous Member, 177 m thick, consists of black shale with bands, lenticles and nodules of calcareous concretions. The Arenaceous Member, 234 m thick, is characterized by dark grey to black laminated siltstone (149 m) and light grey thick-bedded siltstone (85 m). The Calcareous Member is only 16 m thick and is made up of grey calcareous siltstone weathering to brown. This succession, the Chert-Phosphorite to Calcareous members, constitutes the ‘Lower Tal’, and is conformably overlain by the Phulchatti Member (‘Upper Tal’). Samples through the whole column of the ‘Lower Tal’ were collected; all the lithological members, except the Argillaceous Member, have yielded skeletal fossils (Fig. 2).

3. Microfauna

Given below are the three assemblages of the main microfauna recovered (Fig. 3), from base upwards.

**Assemblage I**

Friable sandstone (Chert-Phosphorite Member) contains *Anabarites trisulcatus* Miss., *Tiksitheca korobovi* (Miss.), *Circotheca* sp., *Turcutheca* sp., *Spirellus columnorus* Jiang and *Olivooides alveus* Qian.

**Assemblage II**

Laminated siltstone (lower part of Arenaceous Member) yields *Allonia erromenosa* Jiang, *Dimidia sp. cf. D. simpleca* Jiang and *Hyolithellus* sp.

Grey siltstone (upper part of Arenaceous Member) bears *Allonia sp. cf. A. erromenosa* Jiang, and *Dimidia simpleca* Jiang in association with the trace fossils *Skolithos* sp. and *Taphrhelminthopsis circularis* Crimes.

**Assemblage III**

Calcareous Member contains *Pelagiella lorenzi* Kobayashi, *Auriculatespira madianensis* Zhou & Xiao, *A. andunca* He & Pei and *A. sp.*; the latter genus can be distinguished from the former by a much narrower and elongated apertural opening than in *Pelagiella* (Fig. 31).

The fair preservation of microfossils affords ready observation of morphological features and satisfactory identification. The fossil specimens are deposited in the Palaeontology and Stratigraphy Division, Geological Survey of India, Calcutta bearing GSI type nos. 19833, 19834, and 20192 to 20207.

4. Correlation and age

The present microfaunal assemblages containing several cosmopolitan taxa have considerable similarities with those known from the Meishucunian to Qiongzhusian stages of China, which may approximately correspond to the Tommotian and Atdabanian stages of the Russian Platform. The lithological succession of the present area also has close similarity with the Chinese sequence (Kumar, 1984).

Assemblage I consists of *Anabarites trisulcatus, Tiksitheca korobovi, Spirellus columnorus, Olivooides alveus, Turcutheca* sp. and *Circotheca* sp., which characterize the earliest fossil zones of the Meishucunian Stage in China – the *Anabarites–Circotheca–Protohertzina Zone or Zone I* (Xing Yusheng et al. 1984). The absence of *Protohertzina* in the present...
assemblage is notable as it is present in abundance in the adjoining section of the Mussoorie area (Bhatt, Mamgain & Misra, 1985), where Anabarites trisulcatus has, however, not been recorded. Anabarites trisulcatus and Tiksitheca korobovi also characterize the earliest fossil zone of the Tommotian sequence of the Russian Platform (Missarzhevsky & Rozanov, 1969, tables 7 and 8) – the Aldanocysthus sunnaginicus Zone (Cowie & Rozanov, 1983).

The association of chancelorids, Allonia and Dimidia, in assemblage II, is quite significant as these are zonal guide
fossils characterizing the topmost part of the Meishucunian Stage – the Eionovitatus-Sinosachites— Ebianotheca Zone or Zone III (Xing Yusheng et al. 1984), in the stratotype section at Meishucun, Jinping County, Yunnan, China (Luo Huilin et al. 1982, 1984). These chancellorids are recorded here for the first time from the Himalayan region. The assemblage of these distinctive chancellorids in the Himalayan region confirms that Zone III of the Meishucunian Stage of China extends westwards in the Tethyan belt at a similar stratigraphic level.

The presence of the gastropod Pelagiella lorenzi, in association with Auriculatespira madianensis and A. andunca in Assemblage III, is again quite significant. Pelagiella lorenzi is known from the Artadianian Stage in the U.S.S.R. and England (Matthews & Missarzhevsky, 1975). However, some reviews of Siberian taxa (Sokolov & Zhuravela, 1983; Rozanov & Sokolov, 1984) indicate a Botomian and possibly latest Artadianian age for this taxon (attention to this information was kindly drawn by M. D. Brasier, University of Hull, England). Pelagiella sp. is also known from the Early Cambrian Callavia Zone of the northern Antigonish Highlands, Nova Scotia, Canada (Landing, Nowlan & Fletcher 1980). In the Chinese sections, Pelagiella sp. is recorded from the Qionghuanshan Stage (Xing Yusheng et al. 1983). Until its present discovery in India, the gastropod genus Auriculatespira has only been recorded in China. The genotype, A. andunca He & Pei, is described from the Tjanglangpuian Stage in the Xinji Formation of Henan (He Tinggui, Pei Fang & Fu Guang-Hong, 1984). Auriculatespira madianensis has been described from a middle Early Cambrian sequence (Qionghuanshan Stage) of the Yutaishan Formation in Huanian and Huoqing counties, Anhui Province, China (Zhou Benhe & Xiao Ligong, 1984). The available Chinese literature indicates that Pelagiella and Auriculatespira range from the Qionghuanshan Stage to the Tjanglangpuian Stage. However, in the Lesser Himalayan sequence, the strata yielding this association occur stratigraphically much below the beds bearing a Botomian (= ? Tjanglangpuian) brachiopod assemblage. In the Lesser Himalaya, therefore, the strata of the Calcareous Member, which contains the gastropod association in the present sequence (Fig. 2), are being considered Qionghuanshan in age.

Based on the above chronostratigraphic inferences, the proposed correlation of the Ganga Valley sequence with that of the Chinese stratotype section is given in Figure 4. The microfauna representing Meishucunian Zone II of China, probably corresponding to the Argillaceous Member of the Tal Formation, has not been recorded from this area. According to the standing decision of IUGS, the Meishucunian Zone I is regarded as latest Precambrian.

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References

Figure 4. Correlation of the microfaunal assemblages from the ‘Lower Tal’ sequence of the Tal Formation, Ganga Valley, Lesser Himalaya, with that of China.

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<thead>
<tr>
<th>China</th>
<th>India</th>
<th>INDIA (present work)</th>
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<tbody>
<tr>
<td>Eoerdichia Zone</td>
<td>Parabadiella Zone</td>
<td>Pelagiella – Auriculatespira assemblage</td>
</tr>
<tr>
<td>Zong – III (Sinosachites-Conovitatus) Zone</td>
<td>Zone – II (Porphiloboritus – Siphogensochites Zone)</td>
<td>Dimida – Aloenia assemblage</td>
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<tr>
<td>Zone – I (Anabarites – Circotheca – Prototherina Zone)</td>
<td>Anabarites – Tiksitheca – Circotheca assemblage</td>
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