1. Haussuhl, S., *Zeit. Krist.*, 1972, **135**, 287.
2. Madhava, M. S. and Haussuhl, S., *Zeit. Krist.*, 1975, **142**, 322.
3. Chandrasekhar, S. and Madhava, M. S., *Acta Crystall.*, 1967, **23**, 911.
4. Chandrasekhar, S. and Madhava, M. S., *Mater. Res. Bull.*, 1969, **4**, 489.
5. Madhava, M. S., *Proc. Indian Acad. Sci.*, 1970, **A72**, 67.
6. Chandrasekhar, S., *Proc. R. Soc.* (*London*), 1960, **A259**, 531.
7. Ramachandran, G. N., *Proc. Indian Acad. Sci.*, 1947, **A25**, 260.

MICROPLANKTONS FROM THE LATE PRECAMBRIAN SIMLA GROUP, HIMACHAL PRADESH

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ABSTRACT

The "unfossiliferous" Precambrian Simla Group sediments (silty shale, siltstone, sandstone) in parts of Himachal Pradesh, revealed microplanktons, common to profuse, comprising acritarchs: *Granomarginta primitiva, G. simlaensis* sp. nov., *G. dhalii* sp. nov., *Vavososphaeridium* sp. A, and cyanophytes: *Satpulispora psilata, S. microreticulata* and *S. major.* They suggest a shallow marine condition of some units of the Simla Group and age as late as Precambrian.

INTRODUCTION

THE Precambrian argillaceous "unfossiliferous" sediments of the Lesser Himalayan region of Himachal Pradesh (HP) commonly referred to as the Simla Slates (Simla Group about 4,400 metres thick) are problematic regarding the environment of deposition and age[1-12]. The sequence, however, in HP and Garhwal regions has been suggested as turbidite flysch on the basis of graywacke and sedimentary structures[3-5]. The present author, on the contrary reported the part of the same sequence in the Garhwal (at Satpuli) region as partly restricted, near shore (or protected tidal mud flat) environment on the basis of high concentration of microplanktons, filamentous algal and fungal (?) remains and oxidising nature of sediments [8,10]. The study of the rocks of Simla Group of HP was therefore undertaken (Valdiya's collection lodged in Lucknow University Museum).

The Simla Group in HP has been divided into four units *viz.* Basantpur, Kunihar, Chhaosa and Sanjauli Formations, unconformably overlying the Shali Formation[4,5]. Rocks from Chhaosa and Sanjauli (Lower Member) Formations were selected for the present study. In addition, some rocks of the Simla Group, which could not be placed in proper position were also examined for microorganisms. In general they yielded microplanktons and fungal remains, common to profuse, in quantitative composition (figures 1-14). Although the mode of preservation of fossils is poor (dark brown to black in colour) they can be conveniently identified, as their morphological characters are apparently visible. Table 1 includes stratigraphy of Smila Group of HP[1-5].

MICROFLORAL (MICROFAUNAL) DISTRIBUTION

Olive gray sinus groove-casted and prod-casted siltstone (M.N. 1533) of the Sanjauli Formation (Lower member) (= Dhali Formation of Valdiya[3]), at Bhaili Ridge, NW of Simla, displayed common distribution of acritarchs, *Granomarginata simlaensis* sp. nov. and *Vavososphaeridium* sp. A (figures 2, 3, 6). Further, medium gray flute-casted sandstone (M.N. 1524) of the same formation and locality exhibited *G. simlaensis* sp. nov. and *G. dhalii* sp. nov. (figures 4, 5) in common. However, greenish gray flute-casted siltstone[3] (M.N. 1523) of the Chhaosa Formation[3-5] (at 2 km of Kandaghat) revealed sporadic distribution of filamentous fungal remains (figure 14).

In addition, medium dark gray, flute-casted silty shale (M.N. 1067) of the Sanjauli Formation (Lower Member) at Simla comprises profuse concentration of microplanktons: *Granomarginata primitiva, G. dhalii* sp. nov., ? *Micrhystridium* sp. A, *Micrhystridium* sp. B, *Satpulispora major, S. psilata;* and filamentous fungal remains (figures 1, 4, 5, 7, 8, 10, 14). Whereas, greenish gray laminated siltstone (M.N. 1071) of the above-mentioned formation, at Simla-Phagu road, displayed very high concentration of *Satpulispora psilata* and *S. microreticulata* (figure 9). Medium dark gray sandstone with pseudo-coprolite structure

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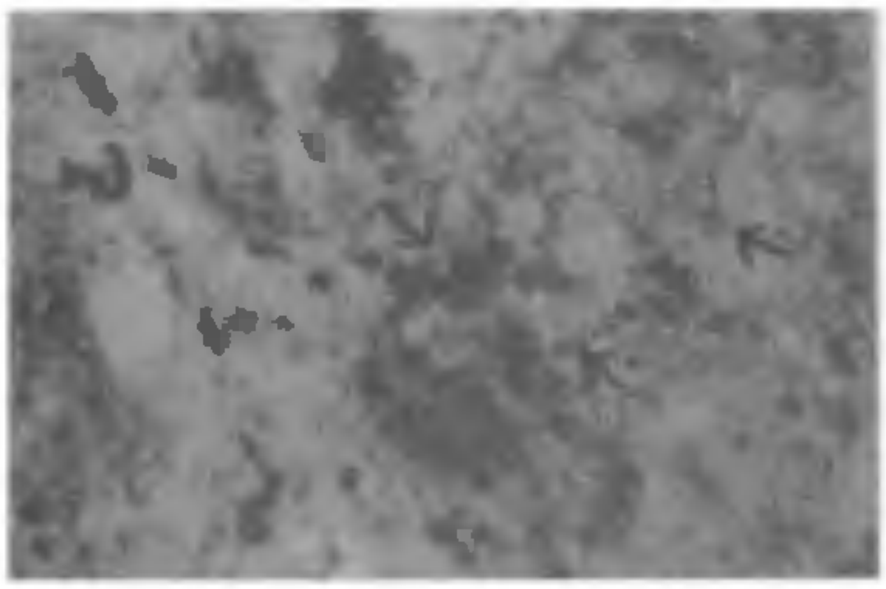

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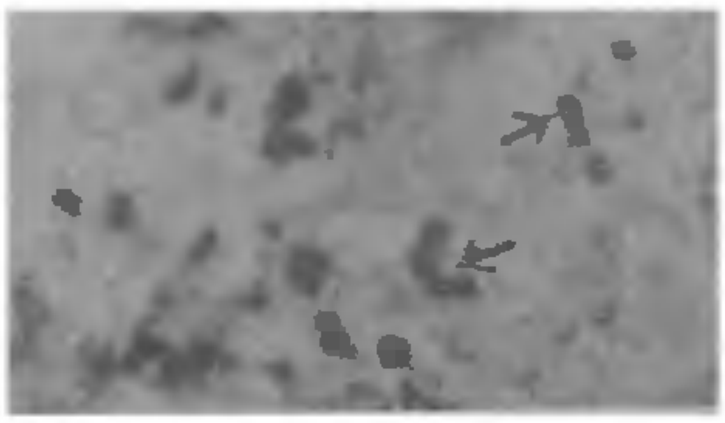

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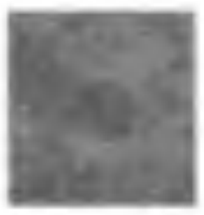

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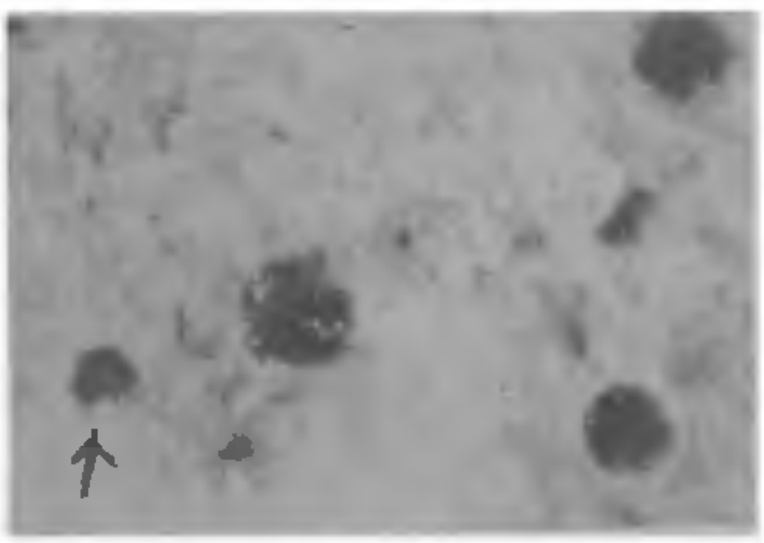

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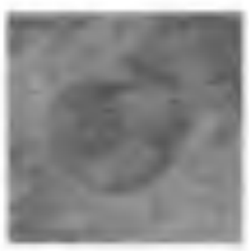

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TABLE 1
Lithostratigraphy of Simla Group, Himachal Pradesh (after Srikantia & Sharma 1971, 1976)

Formation	Member	
Sanjauli (1600m)	Upper	Mainly arenaceous
	Lower	MN 1524
		MN 1533 Both arenaceous and argillaceous
		MN 1067
		MN 1071
Chhaosa (1300m)		Mainly argillaceous MN 1523
Kunihar (450m)		Shale and siltstone with limestone interbeds (Kakarhatti limestone) with *Collenia.*
Basantpur (1050m)	ABCD	
	Unconformity	
		Shali Formation

(M.N. 1029) of the Simla Group (undifferentiated formation), at south of Sanjauli bazar, yielded abundant *Granomarginata simlaensis* sp. nov., *Satpulispora major* and some *incertae sedis* microorganisms.

It is interesting to note that in the adjoining Chakrata (Kumaun Himalaya) region, greenish gray slates (M.N. 1286) of the Simla Group (undifferentiated formation) also revealed sporadic distribution of *Granomarginata simlaensis* sp. nov. and fungal remains.

Figures 1–14. Microplankton and fungal remains from the late Precambrian Simla Group of Himachal Pradesh. All figures × 1,500 approx., except Figs. 2, 9, × 2,000 approx. (in petrographic thin section study). 1. *Granomarginata primitiva* (M.N. 1067), **2, 3.** *Granomarginata simlaensis* sp. nov. **2,** holotype (M.N. 1286); **3,** paratype (M.N. 1286); **4, 5.** *Granomarginata dhalii* sp. nov., **4,** holotype (M.N. 1524); **5,** paratype (M.N. 1524); **6.** *Vavososphaeridium* sp. A (M. N. 1533); **7, 8.** *Satpulispora psilata* (M.N. 1067); (see arrow); **9.** *Satpulispora microreticulata* (M.N. 1071); **10.** *Satpulispora major* (M.N. 1067); **11.** *Satpulispora major* and *Granomarginata* sp. (see arrow) (M.N. 1067); **12.** *Granomarginata* sp. (M.N. 1067); **13.** Chitinozoa-like test (M. N. 1067); **14.** Fungal filament Type A (M. N. 1523).

The systematic description confines only to three important species of acritarchs.

SYSTEMATIC DESCRIPTION

Group: ACRITARCHA Evitt, 1963
Sub-group: SPHAEROMORPHITAE Downie, Evitt and Sarjeant, 1963
Genus: *Granomarginata* Naumova, 1961
Granomarginata simlaensis sp. nov.
(figures 2, 3,)

Test spherical to oval, densely microgranulose, exine moderately thick, peripheral margin absent, usually coated with black carbonaceous matter; test diameter range, 28 × 24 μ to 60 × 62 μ wall thickness range, 0·7 to 1 μ; granule diameter 0·5 μ, separation 0·5 μ. Holotype specimen (figure 2), test diameter 44 μ, (Wild microscope coordinates: Simla 1533, 96·2/37·4); Locality: Bhaiii Ridge (Lower Satpuli Formation), NW of Simla.

Granomarginata vetula (Pl.I, figures 10-12, Salujha *et al.*[15]), from the Kurnool sediments (Late Precambrian to Cambrian) of Andhra Pradesh, differs from *G. simlaensis* sp. nov. in having small test size (11·2 to 20·6 μ × 10·2 to 17·8 μ), wide peripheral margin (± 2 μ) and coarser granules (diameter 1 to 1·5 μ).

Granomarginata dhalii sp. nov.
(figures 4, 5)

Test subspherical, microgranulose, exine moderately thick, peripheral margin absent, mostly covered with black carbonaceous matter; test diameter range, 66 × 74 μ to 92 × 108 μ, wall thickness 1 μ; granule diameter 0·5 μ, seperation 0·5 μ. Holotype specimen (figure 4), test 66 × 74 μ (Wild microscope) coordinates: Simla 1524, 97·3/42; Locality: Bhaili Ridge (Lower Sanjauli Formation), NW of Simla.

Granomarginata sp. B (Pl. 1, figures 1, 2, Venkatachala *et al.*[16]), of the Lower Kaladgi sediments (Upper Precambrian to Lower Cambrian) of South India, differs from *G. dhalii* sp. nov. in having smaller test (45 × 35 μ) and with ill-defined folded wall.

Genus: *Vavososphaeridium* Timofeev, 1956
Vavososphaeridium sp.A
(figure 6)

Test spherical, brown, moderately thick-walled, having fine reticulate ornamentation; test diameter, 20 μ, wall thickness, less than 1 μ, muri 0·5 μ wide. *Vavososphaeridium* sp. A compares with *V. bharadwajii* Salujha, Rahman and Rawat (Pl. 4, figure 35; Maithy[17]) from the late Precambrian Bushimay System of Kanshi, Zaire. The latter species, however, has incomplete reticulate ornamentation on the test wall.

DISCUSSION

Shale, siltstone, sandstone (of the Lower Member of Sanjauli Formation) have profuse concentration of shallow water, marine microplanktons. *G. primitiva* recorded from Precambrian schistone phyllites of Amri Unit, Garhwal; species of *Granomarginata* and *Vavososphaeridium* sp. A from different Precambrian basins of India[13-16], and Kanshi, Zaire[17]; *Micrhystridium* sp. from Late Precambrian to Cambrian in Kurnool sediments of Andhra Pradesh[15], *Satpulispora psilata, S. major* and *S. microreticulata* from Late Proterozoic Simla Group of Garhwal, all indicate shallow marine environment.

Sporadic distribution of filamentous fungal remains in siltstones of Chhaosa Formations may also be indicative of shallow water environment, as similar fungal remains have been observed in the microplankton—bearing silty shale (M.N. 1067), whereas, limestone beds ('Kakarhatti limestones') of Kunihar Formation are stromatolitic with *Collenia*-type [3,5,20] and suggest a shallow shore line or intertidal condition.

It may be interesting to note that problematica microorganisms (Group Acritarcha, *sensu lato*) like *Favosphaera conglobata, F. sola* have been reported from the Lusattian greywackes (uppermost Riphean or Vendian) of Saxony[19]. Moreover, these microfossils were also observed with other acritarchs: *Micrhystridium* sp., cf. *Cymatiogalea* cf. of. *Granomarginata squamacea*, and filamentous alga like structures in the Upper Proterozoic[18], greywacke of Bohemia which suggest shallow marine condition.

ACKNOWLEDGEMENTS

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1. *Pilgrim, G. E. and West, W. D., Geol. Surv. India Mem.*, 1928, **53**, 140.
2. Auden, J. B., *Geol. Surv. India Rec.*, 1937, **71**, 433.
3. Valdiya, K. S., *Bull. Geol. Soc. Am.*, 1970, **81**, 451.
4. Srikantia, S. V., and Sharma, R. P., *J. Geol. Soc., India*, 1971, **12**, 234.
5. Srikantia, S. V. and Sharma, R. P., *Geol. Surv. India Mem.*, 1976, **106**, 33 and 165.
6. Ravi Shankar and Ganesan, T. M., *Him. Geol.*, 1973, **3**, 72.
7. Pande, I. C., *Proc. 62nd. Sess. Indian Sci. Cong. Assoc.*, 1974, **2**, 1.
8. Nautiyal, A. C., *Curr. Sci.*, 1978, **47**, 222.

9. Nautiyal, A. C., *Curr. Sci.*, 1978, **47**, 295.
10. Nautiyal, A. C., *Indian J. Ear. Sci.*, 1979, **6**, 24.
11. Singh, I. B. and Merajuddin, *Him. Geol.*, 1978, **8**, 683.
12. Singh, I. B. *Prec. Res.*, 1980, **12**, 411.
13. Salujha, S. K., Rehman, K. and Arora, C. M., *J. Geol. Soc. India*, 1971, **12**, 24.
14. Salujha, S. K., Rehman, K. and Arora, C. M., *J. Paleont. Soc. India*, 1970, **15**, 10.
15. Salujha, S. K., Rehman, K. and Arora, C. M., *J. Palyn.* 1972, **8**, 123.
16. Venkatachala, B. S., and Rawat, M. S., *Geophytology*, 1973, **3**, 26.
17. Maithy, P. K., *Palaeobotanist*, 1973, **22**, 133.
18. Konzalova, M. *Rev. Palaeobot. Palyn.*, 1974, **18**, 41.
19. Burman, G., *Geol. Jahrb. Dtschl*, 1968, 1972, **4**, 387.
20. Rao, A. R. and Bhan, C. L, *Curr. Sci.*, 1969, **38**, 104, 105.

EFFECTS OF ONION IN ATHEROSCLEROSIS IN RABBITS: IV. MAINTENANCE OF NORMAL ACTIVITY OF AORTIC ENZYMES†

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ABSTRACT

The effects of administration of cholesterol, and cholesterol and fresh whole onion extract on the activity of aortic enzymes are studied. The activities of alkaline phosphatase, acid phosphatase, amino transferases and lactate dehydrogenase in atherogenic diet plus onion extract fed animals remained within normal limits, whereas, in animals fed atherogenic diet alone, these activities showed variations from normal levels.

INTRODUCTION

BIOCHEMICAL research on enzyme activities of normal and atherosclerotic tissues has become a subject of considerable attention in recent years and it is now widely agreed that such investigations constitute an important approach for future evaluation of the pathogenesis of atherosclerosis. Both systemic and local factors are undoubtedly involved in the atherosclerosis. Since enzymes are essential to the biological functioning of tissues, comprehensive studies on the metabolic aspects of arterial walls and alterations in enzymes activities associated with ageing and pathological vascular changes are of fundamental significance.

A few observations have been made on the effects of regressive agents on the enzymes activities during atherosclerosis[1-2]. In the present study the effect of onion extract, which has been found to be a regressive agent by its reducing action on the aortic lesions, lipid and cholesterol levels and by maintenance of erythrocytes shape in atherosclerotic rabbits[3-5], on the variation of aortic enzyme activities in rabbits fed with atherogenic diet has been reported.

MATERIALS AND METHODS

Male albino rabbits of same age (2-3 months) and body weight were initially fed a normal diet (carrot, cabbage and greens). The animals were then divided into three groups with ten animals in each group. Group I served as normal control, Group II animals were fed on atherogenic diet (normal diet plus 0·5% cholesterol) and Group III rabbits were fed on atherogenic diet as above plus fresh extract of 20 g onion. The onion extract which was water soluble was prepared by the method of Stoll and Seeback[6]. The plasma cholesterol in Groups II and III was maintained between 1000–1400 mg% by dietary adjustment of cholesterol. At the end of six months the rabbits were killed. The arterial tree was removed and freed of adventitia. After rinsing the aorta several times in icc-cold saline to remove the adherent blood, a sample of 200 mg wet weight (combined from different parts of the vessel) was homogenized in cold 0·01 M Tris-HCl buffer of pH-7·6. The activities of the following enzymes were determined by the methods as described by King[7].

†This work was carried out at the Biochemical Engineering Division, Indian Institute of Technology, Madras, India.