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Origin and diversification of Precambrian eukaryotes: Evidence from Proterozoic successions of India

Sharma, M., Singh, V.K. and Shukla Y.

Birbal Sahni Institute of Palaeobotany, 53 University Road, Lucknow–226 007, INDIA.

E-mail: mukund_sharma@bsip.res.in

Origin of eukaryotes is a matter of great debate. Molecular fossils, molecular sequence comparison and conventional fossil records do not converge and consensus remains elusive. Since the report of large sized [30-300 μm], well preserved spheroidal vesicles with simple ultrastructure occurring in 3.2 Ga old shales [1] and eukaryotic molecular fossils (2.7 Ga) [2] did not get unequivocal acceptance among the scientific community [3], the questions of advent of eukaryotes in the Archaean and their subsequent diversification remain unresolved. Rise of oxygen and its saturation in the atmosphere around Great Oxidation Event (2.4 Ga) is considered as one of the reasons for fuelling the advent of eukaryotes. Among the morphological variants, the size alone is insufficient criterion to establish the existence of eukaryotes. But the large size, complex ultrastructure, ornamented walls and preservable chemical compositions are a set of diagnostic characters widely agreed upon to establish any morphological entity as eukaryote. At present, therefore, the search for eukaryotic molecular and conventional fossils is targeted in the Proterozoic successions. Sparse fossil record in Palaeoproterozoic and unconvincing but argued large size macrofossil *Grypania* as eukaryotes pushes the search in Meso and Neoproterozoic successions [4, 5].

Indian Proterozoic successions, namely the Vindhyan and the Chhattisgarh Supergroups and Bhima Group, have yielded many well preserved morphologically complex fossils from well age constrained units [Figure-1]. Definitive and probably the oldest eukaryotic fossil specimens of *Shuiyousphaeridium echinulatum*, *Cymatiosphaeroides kullingii* and *Trachysphaeridium* sp. are recorded from the latest Palaeoproterozoic Chitrakut Formation (>1.65 Ga old) of the Vindhyan Supergroup [6]. Specimens of *Tappania plana* from Saraipali Formation and *Valeria lophostriata* with raised parallel ridges on the wall structures and *Jacutianema solubila* are recorded from the Mesoproterozoic Chaporadih Formation (> 1.64 Ga and < 1.0 Ga) of the Chhattisgarh Supergroup. Megascopic carbonaceous compression namely *Sinosabellidites huainanensis*, *Protoarenicola baiguashanensis* and *Pararenicola huaiyuanensis* are recorded from the Hulkal Formation (> 720 Ma old- < 1.0 Ga) of the Bhima Group. These definitive

fossils not only help trace the antiquity of the eukaryotes but also help understand the diversification patterns during Meso and Neo-proterozoic.

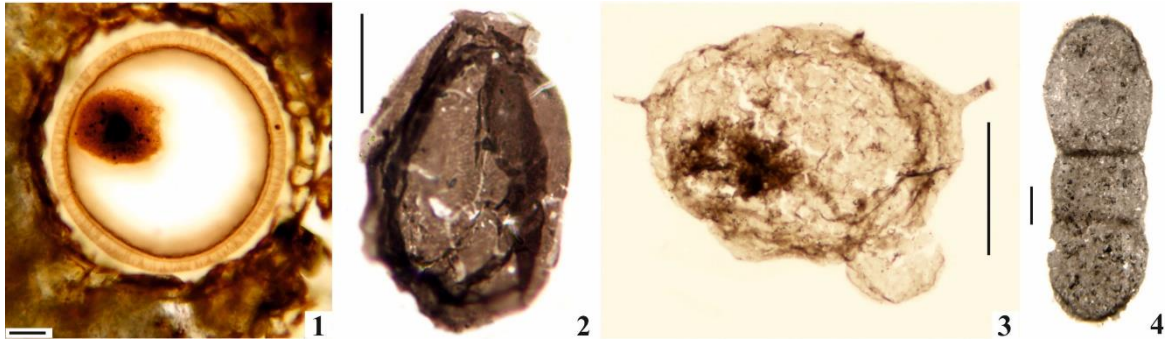


Figure-1-1- *Shuiyousphaeridium echinulatum*, 2-*Valeria lophostriata*, 3-*Tappania plana*, 4-*Jacutianema solubila*. Scale bar = 1 & 3= 50 μ m, 2 & 4 = 25 μ m.

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